REFERENCE BOOK

VALVE-IN-HEAD
McLAUGHLIN
MOTOR CARS

1922

Master Six Series

22-44		Roadster
22-45		Touring
22-46	-	Coupe
22-47	-	Sedan
22-48	-	Coupe
22-49		Touring
22-50	-	Sedan

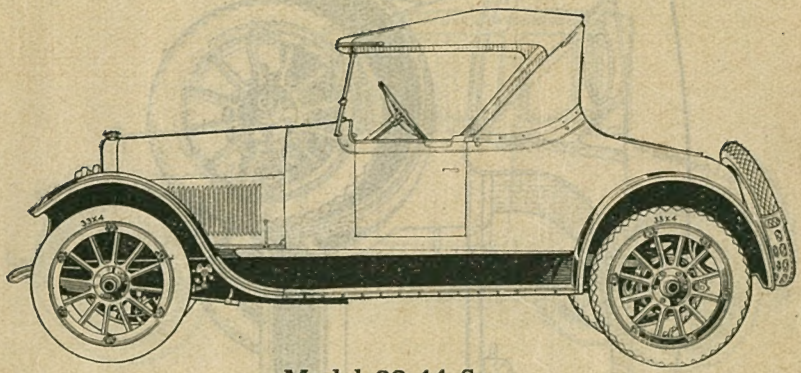
McLAUGHLIN MOTOR CAR CO.,
LIMITED
Division of General Motors of Canada, Limited
OSHAWA - CANADA

INTRODUCTION

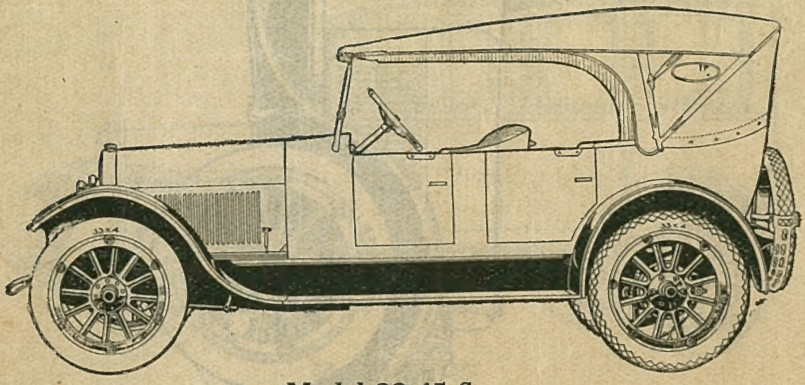
Like any other fine piece of machinery, an automobile requires a certain amount of regular attention, in regard to lubrication and adjustment to keep it operating at its highest efficiency. The information in this book is intended to familiarize the owner or driver with the mechanical details of his car, so that he can give it this attention when necessary, but in case of an accident requiring repairs or replacements, it is expected that the owner will call on the nearest McLaughlin Dealer or service station for expert attention.

Repair parts or any additional information may be obtained from the nearest McLaughlin dealer or from any of the McLaughlin branches and Distributors listed on page 72. In all correspondence concerning the car be sure to give Model and Serial Number, which will be found stamped on a plate fastened to upper toe board, also total mileage car has traveled to date.

McLAUGHLIN MOTOR CAR CO., LIMITED
Oshawa, Ontario, Canada



Model 22-44 Spec.



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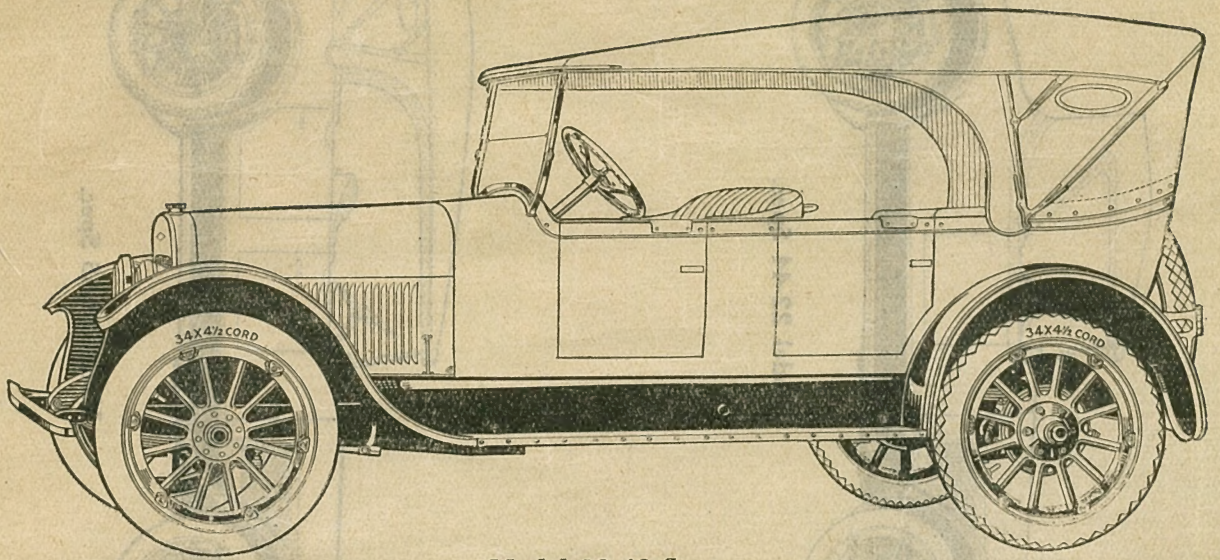

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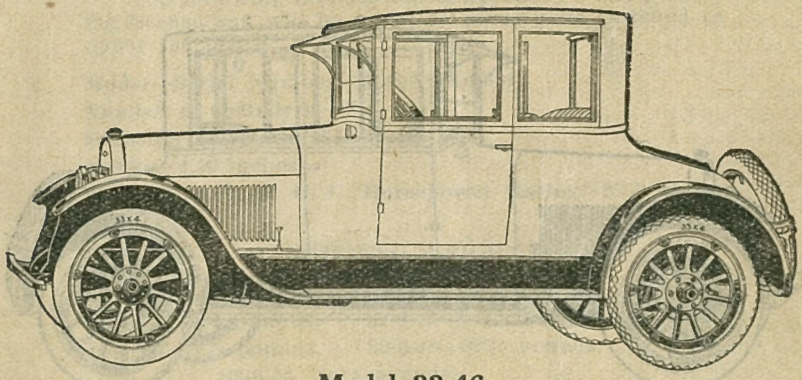

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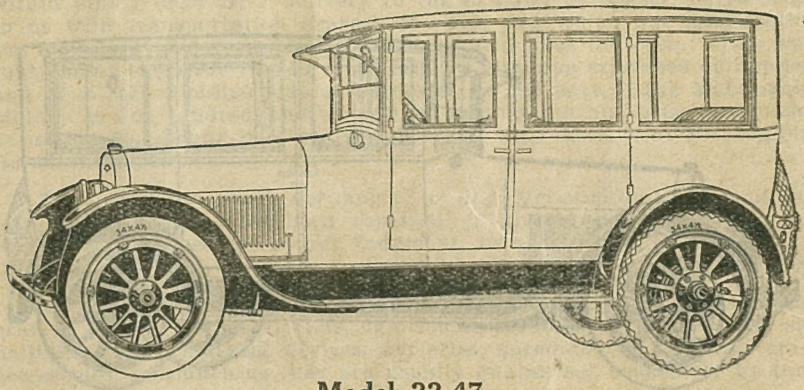

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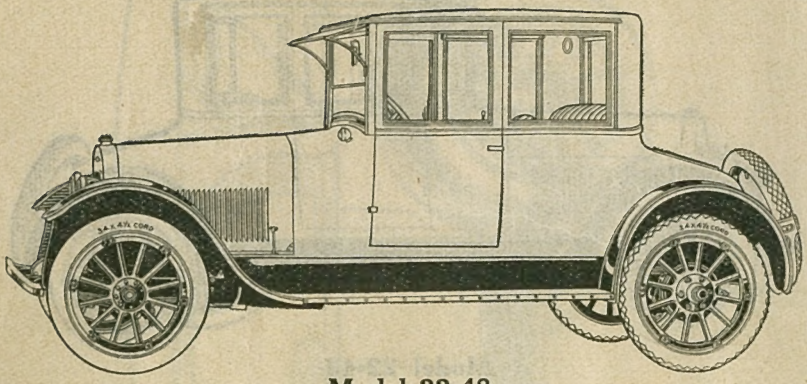

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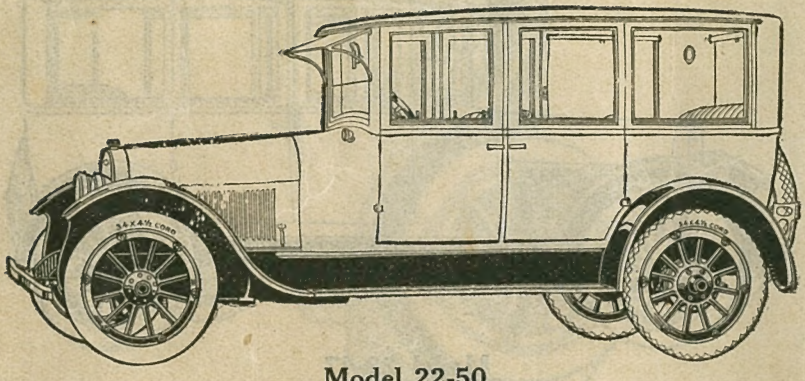


Model 22-50

LICENSE APPLICATIONS

The following information is necessary when procuring license and will be found on name plate fastened to upper toe board:

Model—Serial Number, Motor Number.

Number of Cylinders—Six.

Diameter of Bore—3.375 inches.

Stroke—4.50 inches.

S. A. E. or N. A. C. C. Horsepower Rating—27.3 horsepower.

SHIPPING WEIGHT

22-6-44—2885 pounds. 22-6-47—3425 pounds.
22-6-45—3005 pounds. 22-6-48—3430 pounds.
22-6-46—3235 pounds. 22-6-49—3280 pounds.
22-6-50—3615 pounds.

WARRANTY

The automobiles furnished by the McLaughlin Motor Car Co. Limited, are warranted to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part of parts thereof, which shall within ninety days after delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective: this warranty being expressly in lieu of all other warranties expressed or implied, and of all other obligations or liabilities on the part of the McLaughlin Motor Car Co., Limited, and we neither assume, nor authorize any person to assume for us any liability in connection with the sale of McLaughlin-Buick automobiles.

This warranty shall not apply to any McLaughlin-Buick automobiles, which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect their stability or reliability, nor which have been subject to misuse, negligence or accident.

The McLaughlin Motor Car Co., Limited, makes no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signalling devices, starting devices, batteries, speedometers or other trade accessories, inasmuch as they are usually guaranteed separately by their respective manufacturers.

The McLaughlin Motor Car Co., Limited, reserves the right to make changes in design or add any improvements on McLaughlin-Buick cars at any time without incurring any obligations to install same on cars previously purchased.

McLAUGHLIN MOTOR CAR CO., LIMITED,

Oshawa, Ontario.

OPERATION

Before attempting to drive the car, make sure it is ready for the road. See that there is gasoline in the tank at the rear; that the radiator is filled to the level of the overflow with clean water, or with an anti-freezing mixture in winter; that the engine crank case is filled with oil to the level of the petcock; that the storage battery is properly connected; that the gasoline shutoff cock between the vacuum tank and the carburetor is fully open; and that the car is provided with a driving license, that the fan is working and that the tires are properly inflated. If the car has been standing idle for several days, it may also be necessary to prime the vacuum tank by removing the pipe plug in the cover and introducing a pint or so of gasoline. Be sure to screw the plug in tight when replacing it.

TO START THE ENGINE

See that the ball-topped control lever stands in neutral position, where it is free to move sideways. Set spark and trottle levers on the steering wheel about one-third of the way down the sector. Unlock the switch and turn the ignition lever on switch to point marked "On." Turn air regulator to "choke" position. hold the clutch pedal out with left foot and press the starting pedal.

Pressing the starting pedal sets the electric starter in motion and meshes the gears on its shaft with the teeth in the fly wheel to crank the engine.

If the engine does not start within thirty seconds, release the starting pedal, examine all controls to see that they are properly set and try again. In winter, when the engine is very cold, it will require more cranking, but in ordinary weather the engine should start on the first few turns.

Never hold the starting pedal down for any length of time without stopping to examine the position of the switch, levers, etc., as failure to start is generally an indication that something is wrong and a prompt investigation should be made.

RUNNING POSITION

As soon as the engine starts, turn air regulator to "Hot" position, adjust throttle and advance spark about half way down the sector until engine runs slowly and evenly. The automatic spark advance will now take care of the spark position for all ordinary driving. The foot accelerator can be used to control the speed of the engine. As the engine warms up, the air regulator can be adjusted between "hot" and "cold" positions to obtain even running at all speeds.

Never allow the engine to run any length of time with the air regulator turned to "choke," as this gives an excessively rich mixture and uses an abnormal amount of gasoline and causes crank case dilution.

HAND CRANKING

If the storage battery should be run down or the starter out of order the engine may be started by hand cranking. To crank by hand set switch and air regulator as before. Bring throttle lever one-third of the way down on sector and move spark lever slightly away from topmost position. Remove cap from starting crank below radiator and attach hand crank. Push in on crank until starting clutch is engaged, and turn engine over by pulling up sharply on the crank.

Never try to start an engine by pushing down on the starting crank as a back-fire is likely to result in a broken arm.

TO START THE CAR

To start the car, select a quiet street or level road which has but little traffic. With the engine running slowly and evenly, take position in seat behind steering wheel, grasping the wheel firmly with the left hand. With the right hand, release the emergency brake lever, and push it as far forward as it will go. Place the left foot on the clutch pedal, and press down firmly, holding it in this position, with the right hand, shift the ball-topped lever first to the right, then back.

LOW SPEED

The gearset is now in the first or "low speed" position. Gently release the pressure of the left foot on clutch pedal and at the same time press down slightly on the accelerator pedal with the right foot to increase the speed of the engine. As the clutch takes hold the car will commence to move forward. Continue to press down on the accelerator pedal until the car gains some headway before attempting to change to a second speed.

SECOND SPEED

When the car is well under way, disengage the clutch, at the same time releasing the pressure on the accelerator pedal to prevent the engine racing, and with the right hand shift the ball-topped control lever forward and to the left, then forward again. Engage the clutch immediately and accelerate the engine as before. The car is now in second or intermediate speed.

HIGH SPEED

Again accelerate the engine until the car is moving forward at a rapid pace; operate clutch and accelerator pedals as before; quickly shift the control lever straight back as far as it will go. The car is now in high speed which is the normal driving position.

SHIFTING GEARS

In shifting from a lower to a higher gear, as in getting under way, it is important that the speed of the car be accelerated just before making the change, so that the two gears that are to be meshed together will be running a approximately the same speed. The proper handling of the clutch pedal and accelerator so as to make the engine "pick up" its load quickly, and at the same time prevent it from "racing" when the clutch is released, requires considerable practice.

In changing gears, and especially when starting the car from a standstill, always let the clutch pedal come back gently. If the foot is suddenly removed from the pedal it will let the clutch take hold with a violent jerk.

In shifting gears, from one speed to another, the motion should be made firmly and without hesitation. If the gears fail to mesh correctly the first time, release the pressure on the control lever and clutch pedal for a moment and try again. With a little practice the various changes can be made easily and without noise.

SHIFTING DOWN

Shifting from a higher to lower gear, or "shifting down" is accomplished in the same way as shifting up; that is by releasing the clutch, moving the control lever quickly to the proper position, and engaging the clutch. It will be found much easier to shift gears from higher to lower speeds if clutch pedal is pressed down only enough to release clutch.

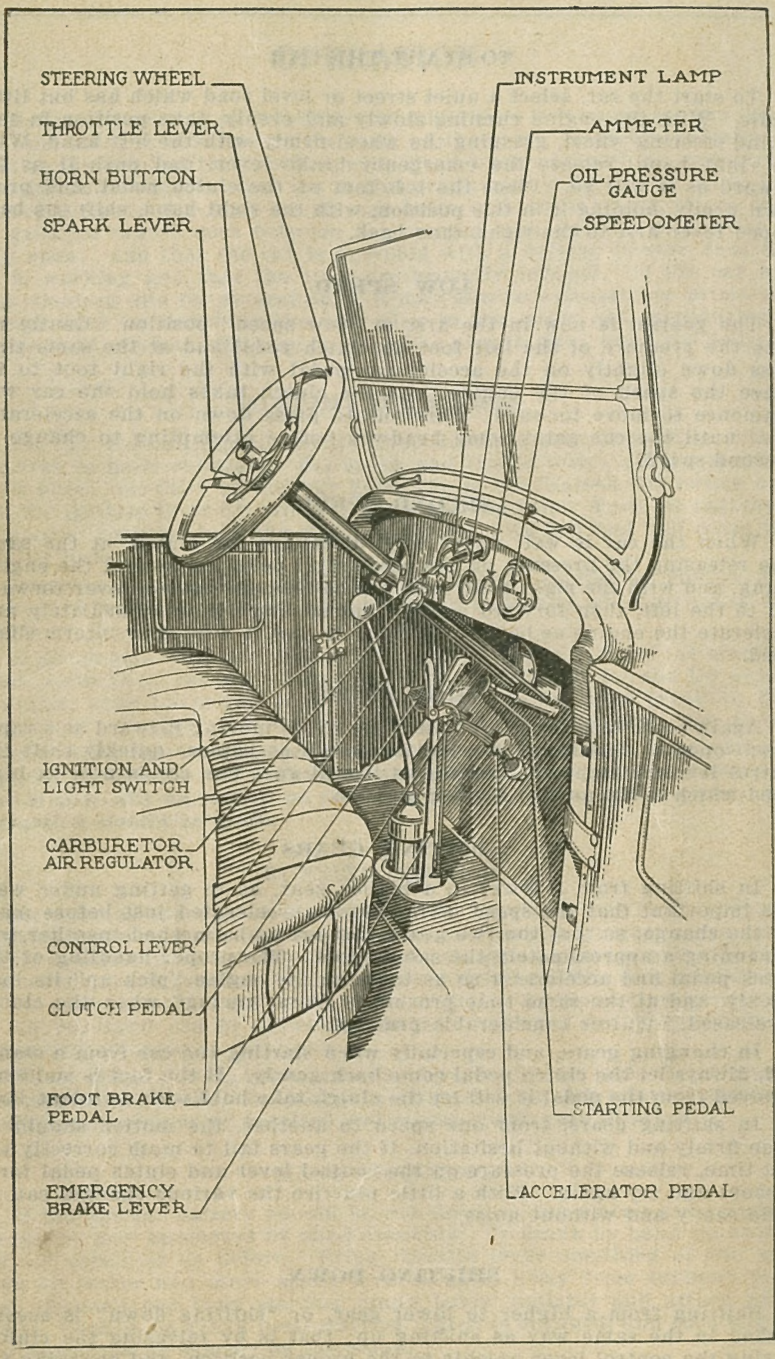


Plate No. 1
Driving Compartment

DRIVING

Ordinarily the car is driven in high or third speed and first or second speeds are used only for starting. Occasionally, however, a steep hill, muddy or sandy road will be encountered which requires more power, and since it is for this purpose that the lower speeds are provided, the driver should not hesitate to use them.

The McLaughlin will climb practically any hill "on high," but after the driver has demonstrated this to his satisfaction, it is suggested that he make use of a lower gear which will not cause so great a strain on his engine.

STEERING

Steering is largely a matter of practice. Drive slowly at first. Do not attempt to turn corners too sharply or too quickly. Always slow down or stop before crossing railroad and car tracks. In a short time a driver gets the "feel" of his car, and then steering becomes almost an involuntary action; so that all the attention can be concentrated on the road. Learn to watch the road from 100 to 300 feet ahead of the car, depending on the speed. In this way there is always time to prepare for obstacles before the car reaches them.

HANDLING THE SPARK

Advance spark lever downward until it comes to the lower arrow point on sector marked "Driving Range." This gives the correct position for all ordinary driving, the automatic spark advance, which is incorporated in the ignition system, will control the spark position without further attention on the part of the driver. It is arranged to automatically advance or retard the spark to the proper position, denpending on the speed of the engine, but as the car slows down, as in ascending a steep hill or negotiating a heavy road, it is necessary to retard the spark by hand until the engine runs smoothly and without knocking.

Never allow the engine to run for any length of time with the spark retarded as such practice only consumes an abnormal amount of gasoline, has a tendency to overheat the engine and causes rapid carbonization.

TO STOP THE CAR

To stop the car, slow down the engine by removing the pressure on the accelerator pedal. If the car retains too much headway apply the service brake by pressing the brake pedal with the right foot until car is brought to throttle speed, and then release the clutch, by pressing on the clutch pedal with the left foot. Shift the control lever into neutral position. The foot may now be removed from the clutch pedal.

TO REVERSE

To reverse the motion of the car, or drive backwards, first come to a full stop. Release clutch and shift control lever to the right and forward. Engage clutch and accelerate engine as before.

Never attempt to reverse the motion of the car before it has come to a complete stop. The car cannot move in two directions at the same time and the result is certain to be serious if this is attempted.

EMERGENCY STOPS

If for any reason it should become necessary to stop the car suddenly press both pedals and at the same time pull back on the emergency brake lever with the right hand. The car should not be stopped suddenly ex-

cept in an emergency as such stopping is extremely hard on the tires and strains the entire mechanism. A good rule is to use brakes and clutch as little as possible and endeavor to control the car with the accelerator.

TO STOP THE ENGINE

To stop the engine turn ignition lever on switch to position marked "OFF" and at the same time open the hand throttle to the starting position. This will allow the engnie to take in a full charge of gas before coming to rest and leave it ready for a quick start next time; also move the spark lever to the starting position and set the emergency brake before leaving the car.

Form the habit of locking the ignition switch when leaving car standing alone. Never leave car with engine running, as this is a useless waste of gasoline and there is always a chance that children or others may throw the transmission gears into mesh.

STARTING ON A GRADE

It sometimes becomes necessary to start the car on an up-grade. To accomplish this, start engine as before, then release emergency brake and hold car with service brake while shifting gears. Now accelerate engine with the hand throttle while gradually releasing pressure on both pedals together. It takes considerable practice in operating the clutch and brake pedals to make the one take hold while releasing the other without "stalling" the engine, but it can be done with a little practice.

SKIDDING

Sudden application of the brakes, especially when turning a corner or on slippery pavement, is liable to make the car "skid." Skidding is caused by the rear wheels suddenly losing their traction while the car is subject to centrifugal force from turning. The result is that the rear end swings suddenly toward the outside of the curve. The best way to avoid skidding is to drive slowly. **When a skid occurs, release the brake for an instant and turn steering wheel in the direction the car is skidding, but do not release clutch.** **(See Page 71 on Coasting).**

Tire chains will be found a convenience when driving on wet pavements or muddy roads, but should not be used unnecessarily.

RACING THE ENGINE

Never open the throttle suddenly when not necessary or leave it open very far when the car is standing and the engine running idle. This is known as racing the engine, and there is nothing more injurious especially when the engine is cold. More engines have been ruined by racing while idle than have ever been worn out in actual driving under load.

SPEEDING

Drive slowly at first. Extremely high speeds are dangerous under all conditions and fifteen or twenty miles an hour on good roads is fast enough for the inexperienced driver. Learn to handle the car properly under all conditions of roads and traffic before attempting higher speeds.

RULES OF THE ROAD

The following "rules of the road" apply to the entire United States and the greater part of Canada. Every driver of a motor car should understand and obey them:

1. When coming to dead stop hold arm out horizontally.
2. When desiring to turn **Right** hold arm out horizontally, then drop 45°.
3. When desiring to turn **Left** hold out arm horizontally, then raise 45°.

4. When meeting a vehicle going in the opposite direction, turn out to the right.

5. When passing a vehicle going in the same direction, pass it on the left, after warning with horn.

6. In turning a corner to the right, keep as close as possible to the right hand ditch or curb.

7. In turning a corner to the left, continue in center of street past the center of intersection of the two roads or streets before making the turn.

8. In stopping the car always stop with the right hand side of the car at the right hand curb.

USE OF LIGHTS

McLaughlin cars are provided with electric lights operated from the switch on the instrument board. For night driving on country roads, both head and tail lights should be turned on by turning the lever on lighting switch to proper position. For city driving and when leaving the car standing at the curb, and meeting vehicles, turn lighitng switch to "Dim." Do not leave the car standing at the curb for any length of time unless turned to dim. A small electric lamp is also provided on the instrument board which is controlled by a separate button on switch and will illuminate the instruments at night.

ADJUSTING HEADLIGHTS

The beams from the headlights can be properly directed on the road by loosening the bolts which fasten the lamps to the fenders. and swinging the bottoms of the brackets. The brightest part of the light should strike the road about 300 feet ahead of the car. The lamps may be focused by adjusting with a screw driver the focus screw found on the back of lamp. Turn screw to the left to shorten focus and reverse operation to lengthen. When properly focused, the light should form a bright circle not over 18 inches in diameter on a wall 50 feet ahead of car.

WATCH THE INSTRUMENTS

Instruments placed conveniently on the instrument board keep the driver constantly informed as to the operation of his car, and he should form a habit of glancing at these instruments occasionally while driving.

The oil pressure gauge tells, by the position of the indicator hand, when sufficeint oil is being circulated through the engine lubrictaing system.

The ammeter shows the amount of current, in excess of that being used for lights and ignition, going to the storage battery. It also shows the amount taken from battery when rotating the armature for idling the motor.

The speedometer gives the speed of the car and the number of miles traveled, both total and trip. The trip register may be set back to zero or to any given figure by turning the knurled finger screw protruding through the face.

To wind the clock on the closed job turn the knurled ring to the right as far as it will go. To set the clock pull out on knurled ring and set the hands by turning to the right or left as the case may be.

THE ALEMITE HIGH PRESSURE LUBRICATING SYSTEM

Thorough and frequent lubrication of all bearings is necessary to riding comfort and life of the car. To make the essential work simple and convenient, the McLaughlin is equipped with the ALEMITE HIGH PRESSURE LUBRICATING SYSTEM.

The Alemite System consists of ball-check valve fittings on all chassis lubricating points, a compressor, and a flexible steel hose. (See Lubrication Chart).

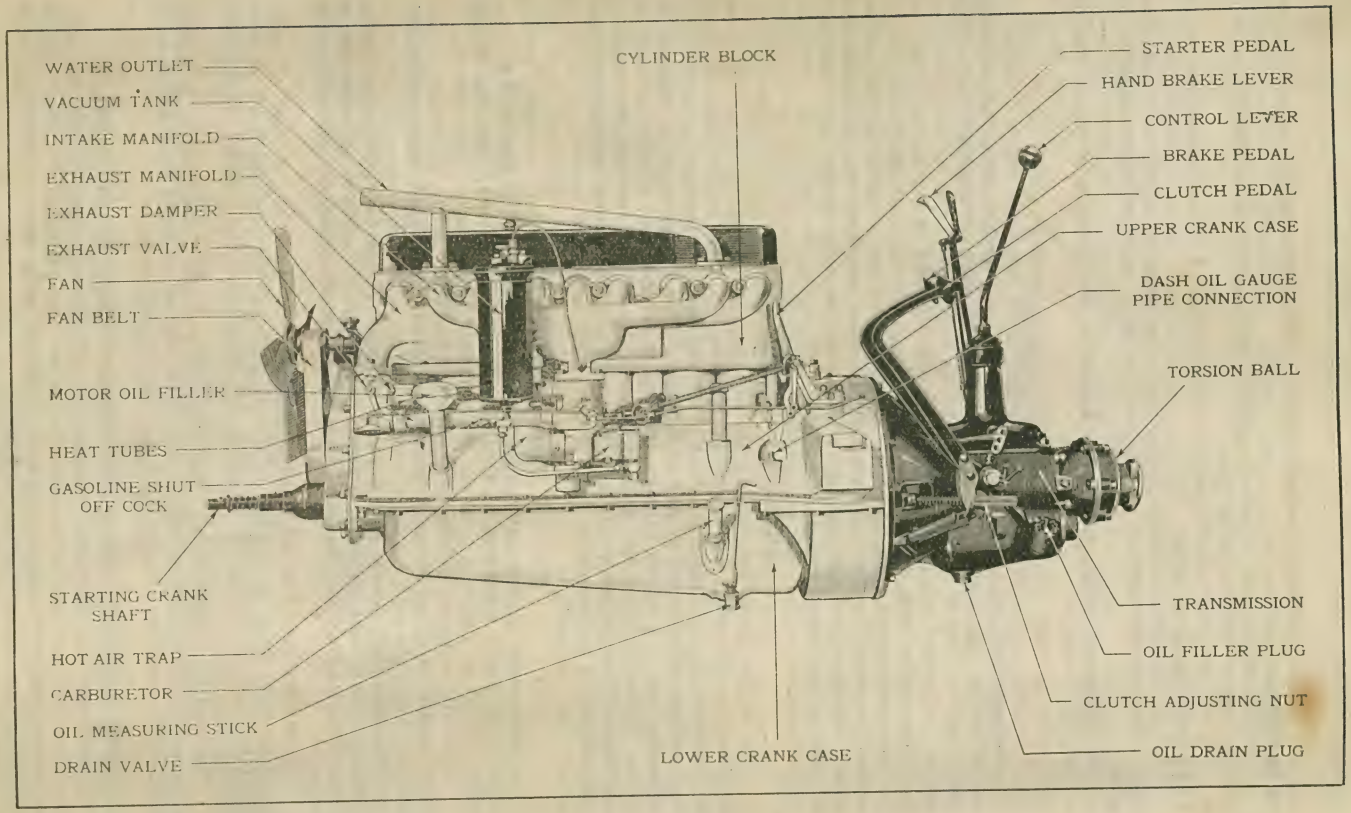
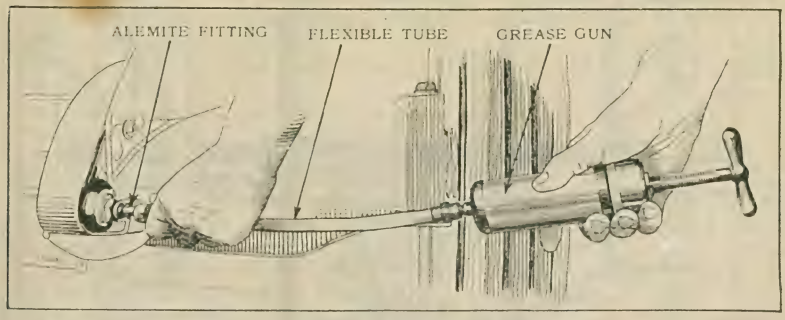
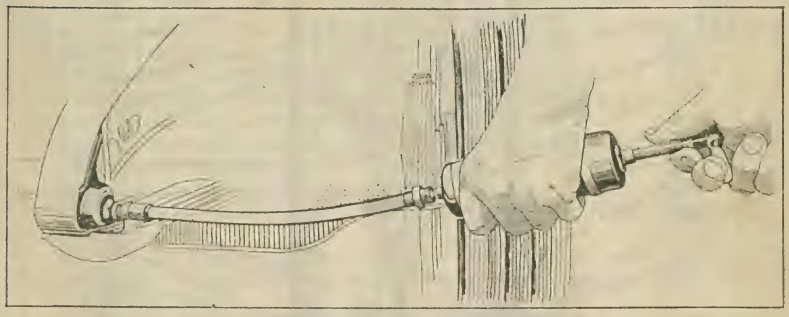


Plate No. 2
Carburetor Side of Power Plant



Adjusting Alemite Gun.



Operating Alemite Gun.

OPERATING THE SYSTEM

Filling the Compressor. Disconnect the hose first. Unscrew removable head of compressor, and turn out piston rod until leather plunger is drawn up inside the head.

Fill cylinder with soft cup grease. A small paddle may be used for packing grease into the cylinder.

When cylinder is filled, replace the head and screw down—**tightening by hand only.** Replace hose by screwing large swivel on lower end of compressor. This may be tightened with a wrench.

Lubricating the bearings. Be sure that the Alemite fittings are wiped free from dust or dirt, in order that fittings will not be clogged or dirt forced into the bearing.

Place the bayonet coupling of hose over the fitting. With a slight pressure forward and a turn to the right, the coupling is locked over the steel pin, and a tight joint is made. Give the compressor handle a few turns, until old grease is forced out on opposite side of the bearing, which assures you that fresh grease has been forced through the contact points. **Use hands only in operating compressor. A pressure of 500 pounds to the square inch is secured in this manner.**

The flexible steel hose will be found a great convenience in reaching ordinarily inaccessible lubricating points. When in use, however, this hose is under tremendous pressure. Care should accordingly be taken not to bend the hose to an acute angle.

Before disconnecting hose coupling from fitting, relieve pressure by reversing handle of compressor two or three turns. The coupling can then be disconnected easily by a slight twist to the left.

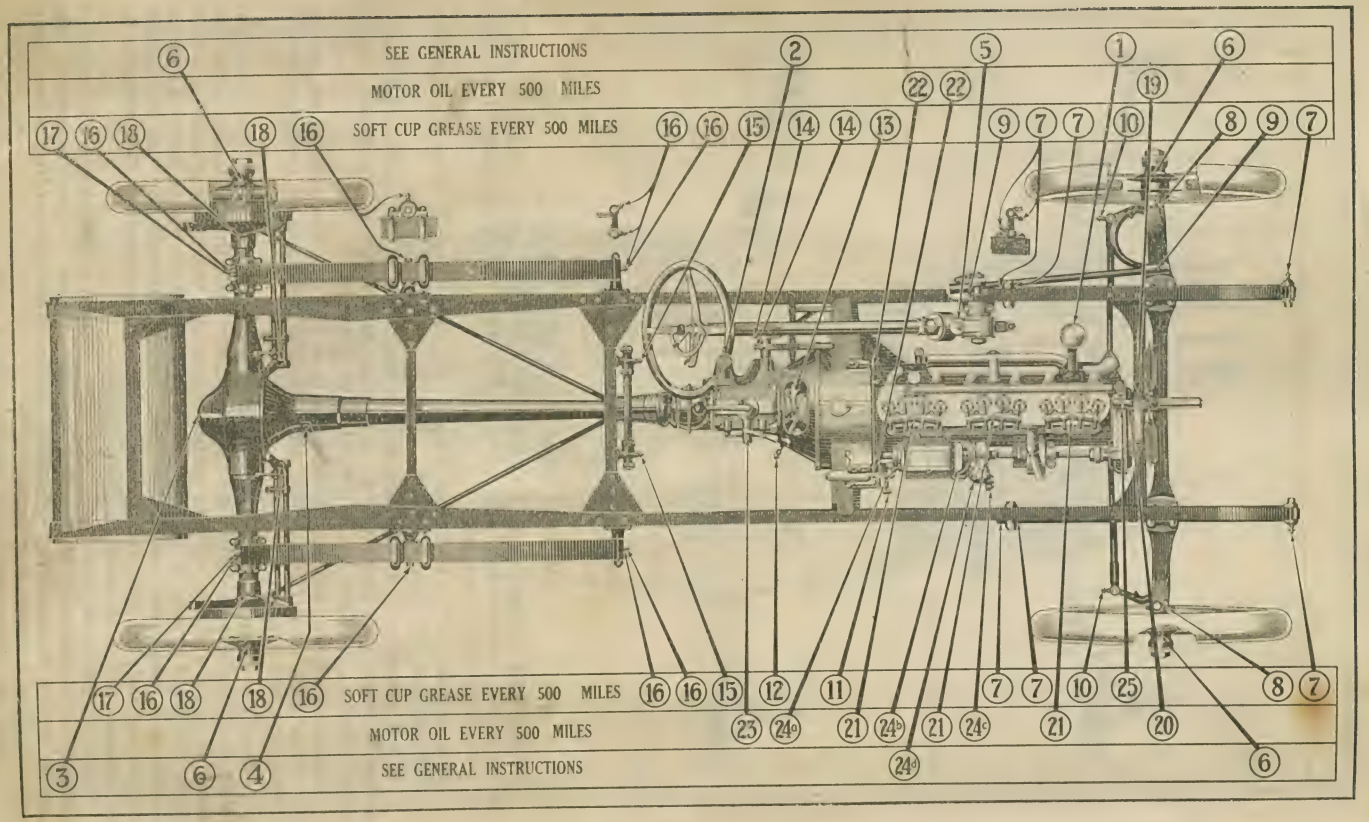


Plate No. 3
Lubrication Chart

GENERAL LUBRICATION INSTRUCTIONS

1. **ENGINE MOTOR OIL.**
Fill through oil filler tube to level of pet-cock or to "Full" mark on measuring gauge.
Inspect frequently and maintain this level.
Crank reservoir holds six quarts.
Drain oil from engine and replace with fresh oil as conditions demand.

2. **TRANSMISSION—STEAM CYLINDER OIL.**
Use Steam Cylinder Oil for all temperatures above freezing. Thin with low cold test engine oil sufficiently to make liquid below freezing temperature.
Remove filler cap on left side of transmission case and fill to level of opening. Inspect frequently.

3. **REAR AXLE—STEAM CYLINDER OIL.**
Use steam cylinder oil for all temperatures above freezing. Thin with low cold test engine oil sufficiently to make liquid below freezing temperature.
Remove plug in differential housing cover and fill to level of opening. Inspect frequently.

4. **PINION SHAFT BEARINGS—SOFT CUP GREASE.**
Remove adjusting cover plate and fill every 1000 miles.

5. **STEERING GEAR—STEAM CYLINDER OIL.**
Insert oil until positive housing is full every 1,000 miles.

6. **WHEEL BEARINGS—SOFT CUP GREASE.**
Remove plugs and fill every 1000 miles.

7. **FRONT SPRING SHACKLE BOLTS—SOFT CUP GREASE.**
Use Alemite gun.

8. **KING BOLTS—SOFT CUP GREASE.** Use Alemite gun.

9. **STEERING CONNECTING ROD—SOFT CUP GREASE.**
Use Alemite gun.

10. **TIE ROD BOLTS—SOFT CUP GREASE.** Use Alemite gun.

11. **STARTER MOTOR SLIDING GEAR SHAFT—SOFT CUP GREASE.**
Use Alemite gun.

12. **CLUTCH THRUST BEARING—SOFT CUP GREASE.**
Use Alemite gun.

13. **CLUTCH RELEASE FORK PIN—SOFT CUP GREASE.**
Remove transmission cover plate and use Alemite gun.

14. **CLUTCH AND BRAKE PEDALS—SOFT CUP GREASE.**
Use Alemite gun.

15. **BRAKE CROSS SHAFT—SOFT CUP GREASE.**
Use Alemite gun every 500 miles.

16. **REAR SPRING SHACKLE BOLTS—SOFT CUP GREASE.**
Use Alemite gun.

17. **REAR SPRING SEAT—SOFT CUP GREASE.** Use Alemite gun.

18. **BRAKE CAM SHAFT—SOFT CUP GREASE.** Use Alemite gun.

19. **FRONT ENGINE SUPPORT—ENGINE OIL.**
Add a few drops of oil.

20. **FAN HUB—ENGINE OIL.** Remove plug and add oil.

21. **VALVE ROCKER ARMS—ENGINE OIL.**
Remove cover on top of engine and fill oil wells.

22. **SPARK CONTROL CROSS SHAFT—ENGINE OIL.**
Add a few drops every 500 miles.

23. **HAND BRAKE LEVER—ENGINE OIL.**
Add a few drops of engine oil.

24. **DELCO UNIT—ENGINE OIL.**
(a) Add 3 or 4 drops of engine oil. (b) Add 3 or 4 drops of engine oil. (c) Remove rear covering and add 3 or 4 drops engine oil. (d) Apply thin coating vaseline to distributor cam and rotor track until surface becomes glazed.

25. **FAN BRACKET SUPPORT—SOFT CUP GREASE.** Use Alemite gun.

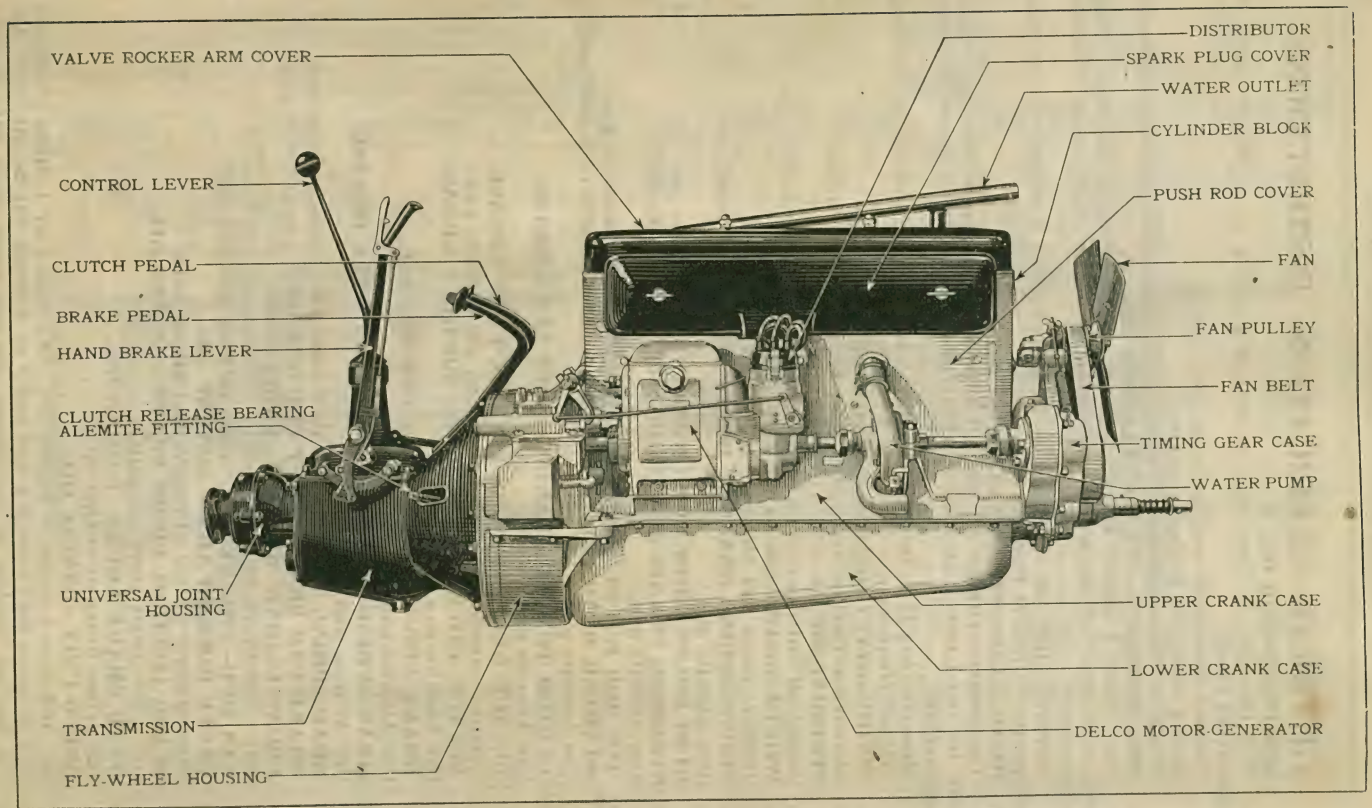


Plate No. 4
Generator Side of Power Plant

OVERHAULING

Three or four times a year all the oil should be drained out of engine transmission and rear axle, and these parts washed out thoroughly with gasoline or kerosene. It pays to change the oil in the engine frequently or whenever it gets thin and watery. Do not use too much oil. Enough is just right, and any more will simply run out of the bearings and collect dust and dirt on other parts of the car.

At least once a year the car should receive a thorough overhauling at which time the engine, clutch, transmission, universal joint, steering gear and front and rear axle assemblies should be taken apart and carefully cleaned and adjusted before being reassembled. If lower half crank case is removed for any reason, be sure and fill all troughs with oil before replacing. When timing gear housing is removed be sure to fill case through plug on top of housing before starting. This work should be done by an experienced mechanic. Springs should be cleaned, car jacked up to take weight off springs and thin oil applied every 2000 miles.

Lubricants

Engine oil should be a high grade, medium heavy, mineral oil, with a flash point of not less than 375 degrees Fahrenheit and a viscosity of 42 to 60 seconds Saybolt at 210 degrees Fahrenheit and not less than 190 seconds at 100 degrees Fahrenheit for use at temperatures below freezing. The cold test of this oil should not exceed 5 degrees Fahrenheit. This oil should be used exclusively in the engine lubricating system, for valve rocker arms, distributor and generator bearings, and for all small joints not otherwise provided with lubrication, such as spark and throttle rods, brake rods, etc. **(Changing Oil in Motor, see Page 71).**

Steam cylinder oil should be a high grade heavy mineral oil with a viscosity of 120 to 150 seconds at 210 degrees Fahrenheit, and should be mixed half and half with engine oil of a cold test not exceeding 5 degrees Fahernheit for use at temperatures below freezing point, for the transmission gears and differential gears. It is better for this purpose than most of the so-called "gear greases."

Soft cup grease should be a homogenous mixture consisting of high grade mineral oil and pure lime soap. It should be free from acids and other adulterants and should be of a soft nature and have a sufficiently high melting point to prevent free flowing in warm weather and should be used in Alemite gun to lubricate parts so equipped.

POWER PLANT

The unit power plant is the most important part of the car. It develops the necessary power for driving the car and deliveres it to the axle and road wheels where it is finally converted into motion of the vehicle.

The power plant consists of:

The engine.
The lubricating system.
The fuel system.
The Delco system.
The cooling system.
The exhaust system.
The clutch.
The transmission gearset.
The universal joint.

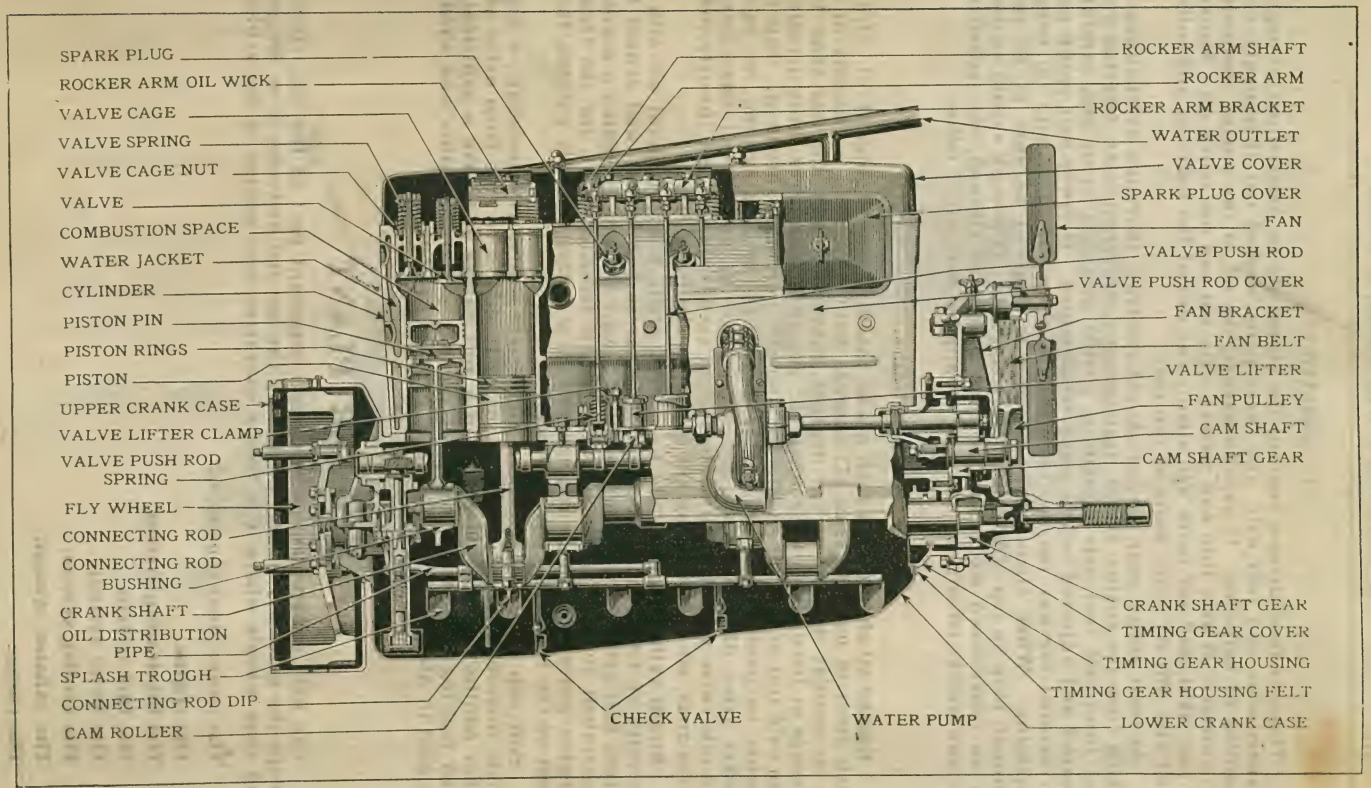


Plate No. 5
Interior Construction of Engine

The engine is the machine which turns the pressure of the exploding gas into rotary motion of the crankshaft.

The lubricating system supplies oil for the different parts of the engine automatically varying the amount to agree with the speed of the engine.

The fuel system draws the raw gasoline from the fuel tank at the rear of the car, vaporizes it, mixes it with the proper proportion of air and delivers it to the cylinders in quantities proportional to the load.

The Delco system generates the electric current, increases its voltage sufficiently to enable it to jump the spark gaps, and distributes it to the cylinders in proper rotation. It also supplies the electrical energy which is accumulated in the storage battery to crank or "spin" the engine for starting and to operate the electric lights.

The cooling system protects the working parts of the engine by absorbing the excess heat of the explosions and diffusing it to the surrounding atmosphere.

The exhaust system carries the waste products of combustion away from the engine and muffles the noise of the explosions.

The clutch is the connecting link between the engine and the transmission, and connects or disconnects the two units at the will of the operator.

The transmission gearset allows the speed of the engine to be varied in relation to the speed of the rear wheels, so that the energy can be applied at a faster rate under certain conditions.

The universal joint is the flexible coupling at the rear of the transmission which connects the power plant to the rear axle and allows the axle to move up and down over the road surface without interrupting the driving effort.

ENGINE

The engine consists essentially of a row of six cylinders in which the gas is exploded, the force of the explosions acting on pistons which move up and down in the cylinders. The pistons are connected by means of the connecting rods with the crankshaft, and as they move up and down turn the crankshaft around in a clockwise direction. At its rear end the crankshaft carries a heavy fly wheel which engages with the clutch and transmits the power on to the rear wheels. Teeth are cut around the rim of the fly wheel and a small gear, driven by the electric starter, engages with these teeth when spinning the crank shaft to start the engine. The crank case which is fastened to the frame of the car, supports the cylinders and encloses the crank shaft and its bearings.

At their upper ends the cylinders have two openings, closed by poppet valves. One of these communicates with the exhaust system and the other with the intake manifold and carburetor. The valves are opened and closed at the proper intervals in the cycle by rocker arms and push rods, actuated by the cam shaft, which is geared to the crank shaft and runs at one-half the crank shaft speed, so that the valves are each opened and closed once for every two revolutions of the crankshaft. The oil pump located in the lower half of the crank case is driven from the rear of the cam shaft.

Spark plugs project into the combustion space at the upper ends of the cylinders and serve to ignite the gas when a cylinder is ready for the explosion.

A double wall or water jacket entirely surrounds the upper part of the cylinders and water is kept constantly circulating through the space

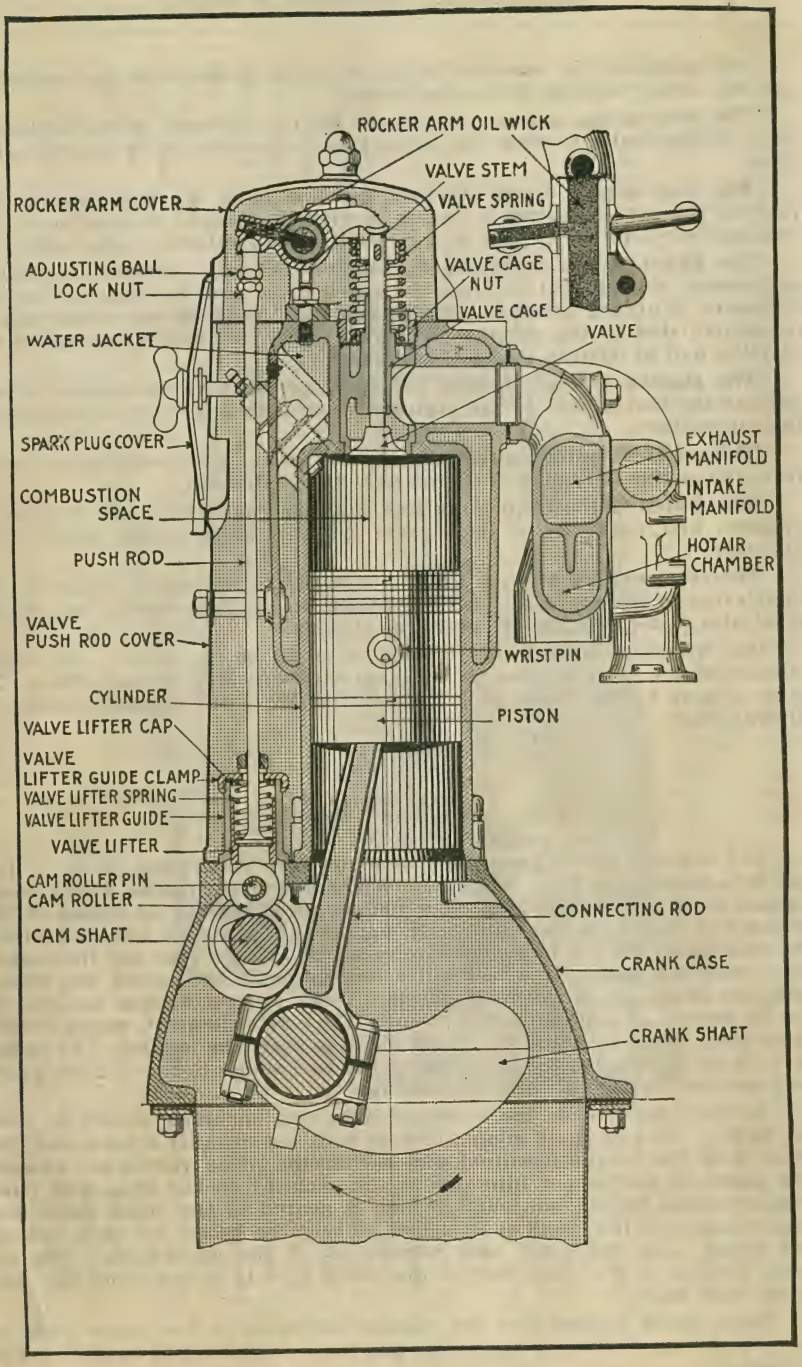


Plate No. 6
McLaughlin-Buick Valve Mechanism

between the two walls by means of the water pump, which is attached to the right side of the crank case and is driven by another shaft geared to the cam shaft. The pump shaft runs 1½ times as fast as the crank shaft and also drives the Delco generator through a coupling at its rear end.

HOW THE ENGINE WORKS

The power of the engine is produced by burning or exploding charges of gas in the cylinders, above the pistons, the resulting pressure forcing the pistons down causing the crank shaft to rotate. In the four cycle engine, of which the McLaughlin engine is an example, it takes four strokes of the piston or two complete revolutions of the crankshaft, for each explosion or working stroke in any one cylinder. This will be more readily understood by reference to the cycle diagram. Plate No. 7.

As the piston starts down on the first stroke of the cycle, as in "A," the inlet valve is opened. The motion of the piston tends to create a vacuum in the cylinder, and this sucks in a charge of fresh gas from the carburetor, through the valve opening .

When the piston has reached the bottom of its stroke, and starts back, as in "B" the intake valve closes and the piston compresses the gas it has sucked in, into the space at the top of the cylinder.

As the piston reaches the end of its upward stroke, as in "C," the compressed gas is ignited by an electric spark which occurs at the points of the spark plug, and the resultant explosion creates a large amount of heat and pressure, which pushes the piston down during the next, or working stroke, and turns the crank shaft.

On the return upward stroke of the piston, "D," the exhaust valve is opened, and the piston pushes the remaining burnt gas out through the exhaust pipe, leaving the cylinder empty and ready for the beginning of a new cycle.

It will be noticed from the above that only one stroke out of the four is a working stroke in any one cylinder, but as the engine has six cylinders, the crank shaft actually receives three impulses every revolution.

TIMING THE VALVES

The exact point in the cycle at which the valves are opened and closed is determined by the shape of the cams which operate them and by the angular relation between the camshaft and crankshaft. If it should ever become necessary to remove one of these shafts or the gears which drive them, they must be replaced in proper relation to one another or the valves will be "out of time." To obtain this relation, the punch-marked tooth on the crank shaft gear should be set to match with the punch-marked space on the cam shaft gear.

ADJUSTING PUSH RODS

With the timing gears properly matched, the final setting of the valves can be made by adjusting the push rods to proper length by means of the adjusting ball ends and lock nuts. This adjustment should be made while engine is warm.

To make this adjustment, turn engine by hand in clockwise direction until exhaust value on No. 6 cylinder is closing, then observe fly wheel inspection hole until marking "No. 1 and No. 6" on fly wheel comes in line with mark on edge of hole. This is the firing position for cylinder No. 1 and these valves can be adjusted to .010" clearance between end of valve stem and rocker arm. (See instruction plate on side of motor).

This is approximately the thickness of a sheet of heavy paper or very

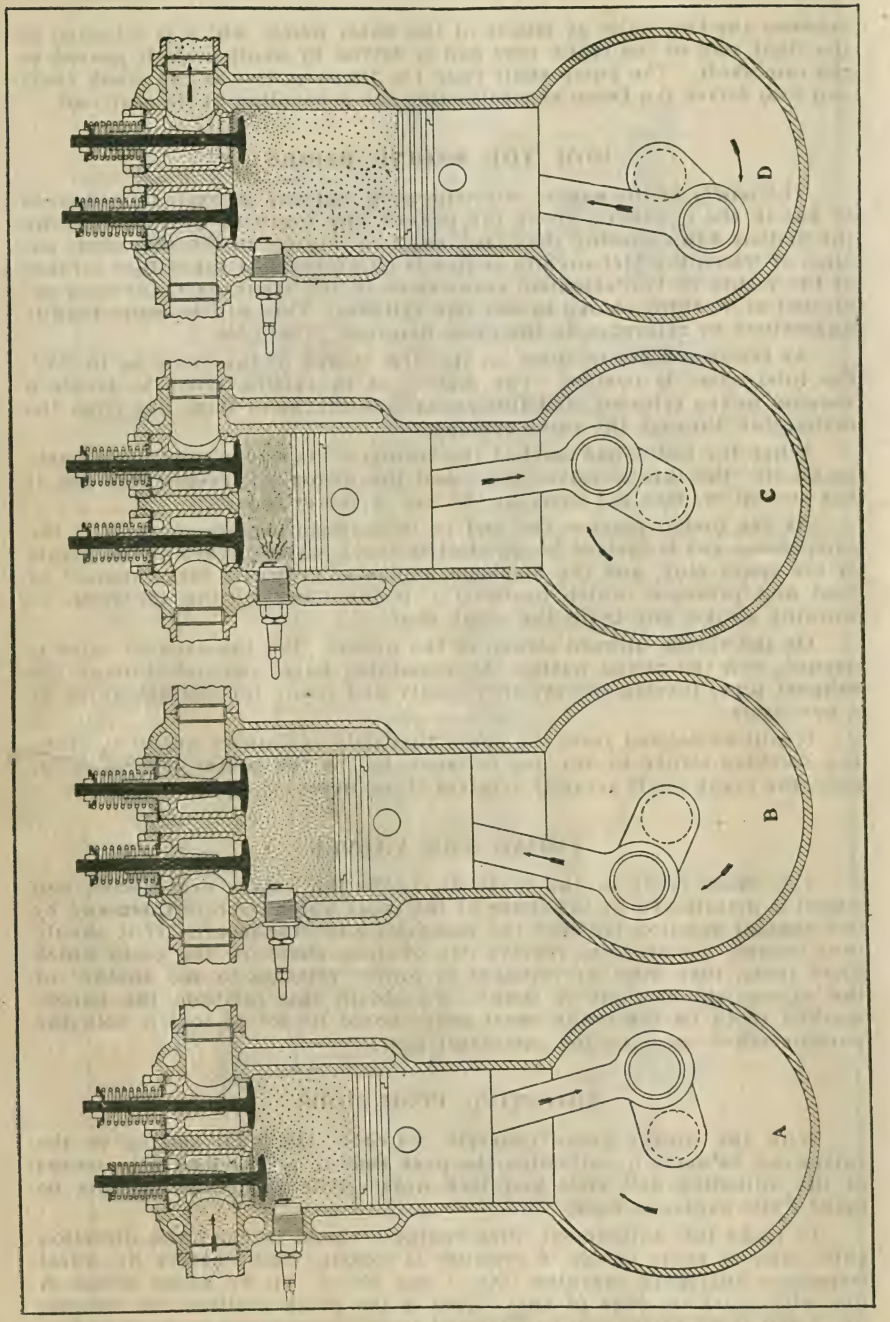


Plate No. 7
Cycle Diagram

light card. Push rods for the other cylinders may be adjusted in the same manner. Best results will be obtained if the above adjustments are made while engine is idling and no one but an expert should attempt adjustment with engine running.

One-half teaspoonful of kerosene inserted around the valve stem at least once a week while engine is running will keep valve free from carbon and prevent it from sticking in the valve guide.

In setting the marks on the fly wheel be careful to turn the engine only in clockwise direction, otherwise the backlash in the timing gears will affect the result.

GRINDING VALVES

To keep the engine up to its maximum efficiency, the valves must be gas tight when closed. When leakage occurs the valves should be ground as follows: Compress valve spring and lift push rod out of socket in valve lifter. Loosen valve cage nuts with the special drift furnished in tool kit and remove by unscrewing. A light tap with a hammer on the end of the valve stem will loosen cage so it may be withdrawn. Be careful not to injure the small bronze packing ring on top. Remove valve spring and after cleaning with gasoline or kerosene, smear the valve and its seat with fine emery flour and oil, or with one of the grinding pastes now on the market. Grind, by turning valve back and forth on its seat until both valve and seal show a bright ring 1/32 inch wide all the way around.

In grinding the valve it should be lifted from its seat occasionally to insure even grinding.

Be careful to clean out all traces of abrasive material before replacing valve.

Be sure to replace valve stem before reassembling in cage.

After grinding valves, it will usually be found necessary to readjust the push rods to compensate for the wear.

REMOVING CARBON

Too much lubricating oil or too rich a mixture will form carbon in the cylinder. An excessive deposit of carbon sometimes becomes incandesecnt and ignites the charges before the piston has finished its compression stroke, resulting in a knock in the engine.

The carbon deposit in the compression chamber may be burned out with an oxygen torch through the spark plug holes.

ADJUSTING BEARINGS

A sharp, metallic knock in the engine, audible every revolution of the crank shaft, may mean that one of the bearings is loose. If retarding spark or removing carbon does not stop the noise, remove lower half of crank case and examine bearings.

When the loose one is located, it can be taken up by removing the cap and taking out one or more of the thin metal shims. The same holds true of the connecting rod bearings. Note that bearing is bright and shows no indication of a lack of lubrication.

INSERTING PISTON RINGS

Piston rings seldom break, but if one does it can be most easily replaced by removing the connecting rod cap and pulling piston and rod out from below. The rings may be slipped on or off the piston by inserting

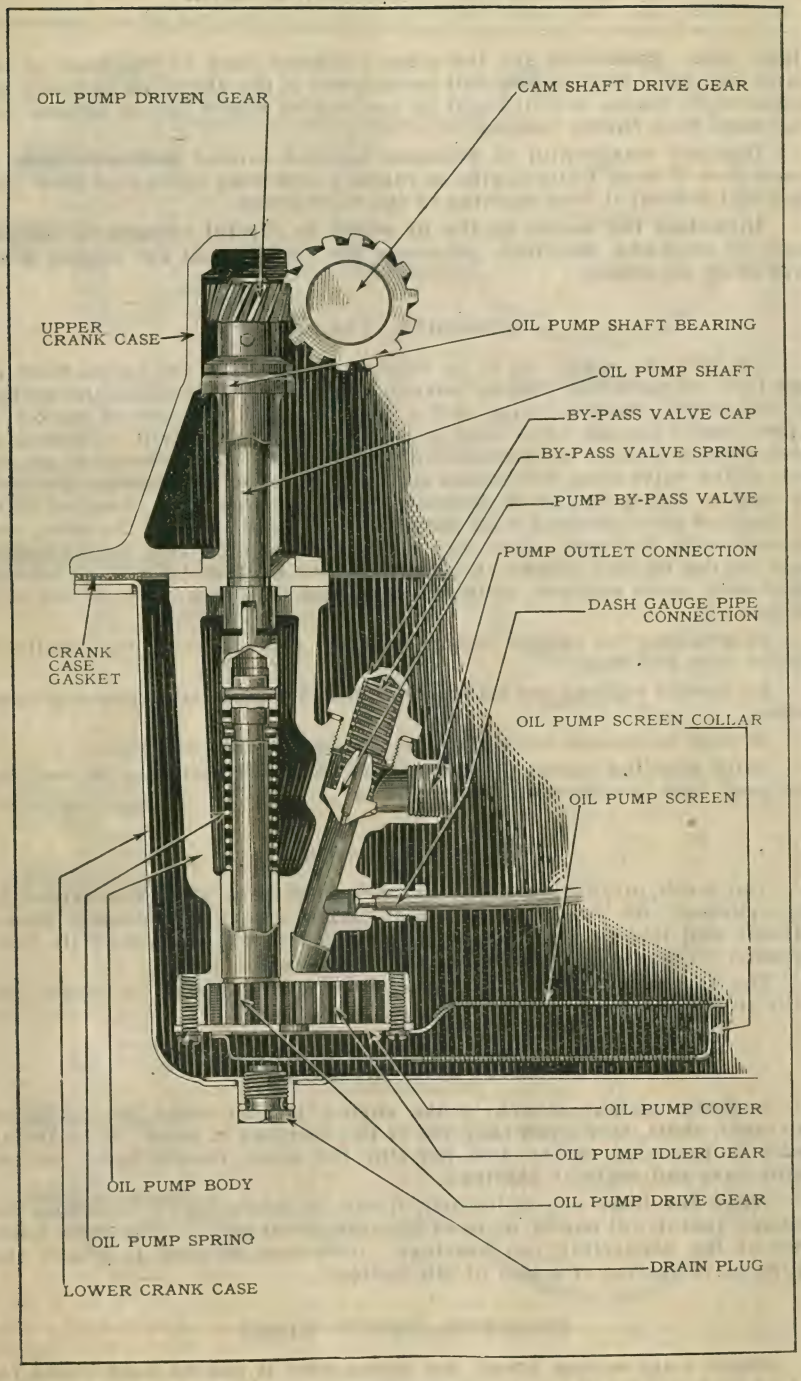


Plate No. 8
Oil Pump and Shaft

thin strips of sheet metal under them to prevent their dropping into the grooves, until in their proper places.

ASSEMBLING CONNECTING RODS

In assembling connecting rods to the crankshaft, it should be noted that the connecting rods are offset from the centre line with relation to the bearings and great care should be exercised when assembling rods to see that the identification marks, which are a raised pad and the forging number (152031 or 152032) in the channel of the rod, are assembled next to the adjacent main crank shaft bearings. This also brings the smooth channel of the rods facing each other in pairs between the main crank shaft bearings. Also the pistons should be assembled and fitted in the motor so that the piston pin cotters or piston pin set screws face toward the front of the motor.

KEEPING THE ENGINE CLEAN

Nothing will add more to the appearance of the car when the hood is raised, than a clean engine. Use soft cloth moistened with gasoline or kerosene and a stiff brush to get dirt out of sharp corners.

ENGINE LUBRICATING SYSTEM

The engine is provided with an automatic lubricating system which operates as follows:

Oil from the reservoir, in the lower half of the crank case, is drawn through a strainer into the gear pump enclosed in the rear end of the lower crank case. (See Plate No. 8).

The oil pump forces the oil through a pipe past a by-pass valve and the spring tension exerted on the by-pass valve causes the pressure gauge to register on the cowl instrument plate.

After passing the by-pass valve the oil flows through the distributor pipe to splash troughs fastened in the lower half of the crank case into which the connecting rods dip, forcing some of the oil through oil grooves up into the connecting rod bearings and splashing remainder over the interior of the crank case and up into pistons and cylinders.

As the oil drains back, it is caught in ducts and led to all the bearings of the engine, a quantity passing from the front main bearing pocket through a hole in the back wall of timing gear case thereby lubricating the gears, the excess falling back into the reservoir to be used over again. The normal oil pressure as indicated by the hand on the pressure gauge is four pounds. If indicator hand or pressure should fall to zero while engine is running, the engine should be immediately stopped and an investigation made to ascertain if oil in crank case is up to required level, should it prove to be so, an examination of the by-pass valve, located in oil pump, should be made, as the small hole will probably be found to contain some foreign substance which is preventing the flow of oil.

OIL CIRCULATING PUMP

The oil pump consists of two small gears enclosed in a close fitting housing and driven by a vertical shaft and spiral gears from the cam shaft. As the gears turn, they take the oil into the spaces between their teeth and carry it around to the outlet, where the action of the teeth meshing together squeezes the oil out of the spaces and forces it to flow through the distributor pipe. The pump is automatic in action and requires no attention or adjustment, except the addition of fresh oil to the crank case reservoir, as often as necessary to keep the oil level up to the petcock, unless greater oil pressure is desired for better lubrication of cylinder walls when the following adjustments could be made.

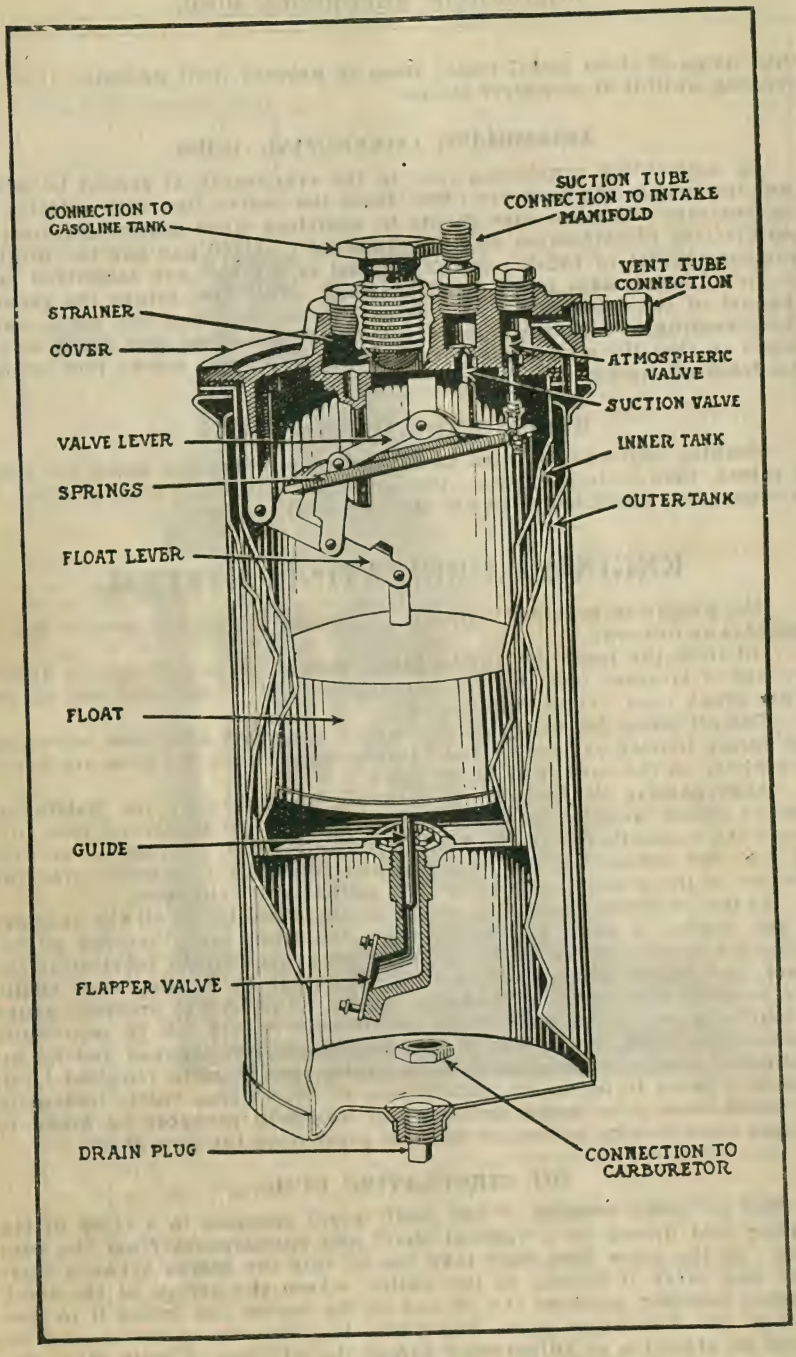


Plate No. 9
Vacuum Tank

IT IS VERY IMPORTANT THAT CYLINDER WALLS AND PISTONS AS WELL AS BEARINGS IN A MOTOR HAVE SUFFICIENT LUBRICATION. It not only eliminates undue wear on all surfaces but greatly helps in keeping good compression which is necessary if the maximum power is expected. To increase the pressure or amount of oil delivered by the pump the following detailed instructions should be carried out. (See Plate No. 8).

1. Take Oil Pump off and fit Oil Pump Cover or plate, which is on the botto mof the pump closer to the gears by installing thinner gasket under oil pump cover. This moves the plate closer to the Oil Pump Drive and Idler Gears, in that way reducing the clearance between the gears and cover and forcing all the oil to be pumped through the gears causing higher pressure. GEARS, HOWEVER, MUST NOT BE ALLOWED TO BIND AGAINST COVER.

2. Also put additional gasket, under By-pass Valve Cap. It will be found that one gasket is already fitted at this point. The additional gasket relieves a certain amount of tension on the By-pass Valve Spring and in that way additional quantity of oil is allowed to go by the By-pass Valve, to all parts of the motor.

To check extent of oil film on cylinder walls remove spark plugs and check condition of cylinder walls by feeling through spark plug hole. Oil pressure gauge cannot be considered in checking proper lubrication of cylinder walls as the gauge may not be registering correctly.

Oil pressure will also be effected by the condition of the oil in the motor. If oil has become thin and watery proper oil pressure cannot be secured. If this condition exists, old oil should be drained out and oil reservoir refilled with good oil. (See Page 17—Changing Oil in Motor.) Loss of power is sometimes due to lack of proper oil seal between pistons and cylinder walls, which allows loss of compression.

OIL PRESSURE GAUGE

The oil pressure gauge merely indicates circulation of the oil, and does not show when the supply in the crank case reservoir is running low. Watch and test the oil level in the crank case by reading measuring stick.

Caution! Do not attempt to determine oil level while engine is running and wipe measuring stick clean before taking correct reading.

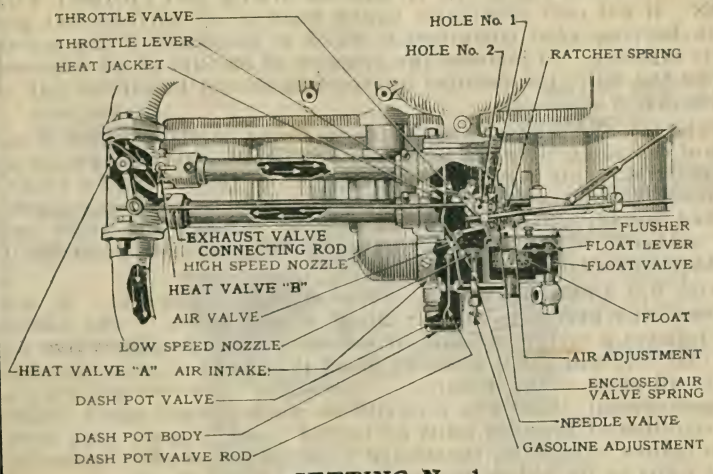
FUEL SYSTEM

The fuel system consists of the gasoline tank, piping, vacuum tank, carburetor and intake manifold. There is nothing connected with the gasoline tank or piping to get out of order, the chief consideration being to carefully strain all gasoline and to avoid leaks which are sometimes caused by road vibration.

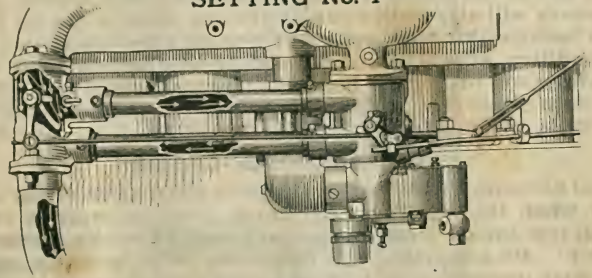
VACUUM TANK

The vacuum tank draws the fuel from the gasoline tank at the rear and delivers it to the carburetor at a constant head, as needed. It consists of two steel shells, the inner one of which encloses the float and the valve mechanism attached to the cover, while the outer one acts as the fuel reservoir and is connected to the carbuertor. The float operates two small valves which control openings connected to the inlet manifold and to the atmosphere. A flapper check valve closes the bottom of the inner shell. As the inner shell empties, the float falls and closes the atmospheric valve and opens the suction valve.

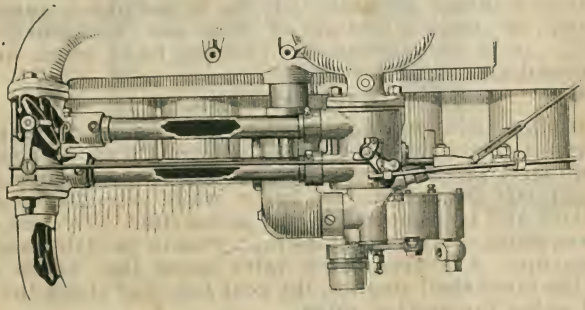
The suction of the pistons tends to create a vacuum in the inner shell, drawing gasoline into the inner tank from the main fuel tank at the rear of the car. When the inner tank has filled, the float rises, closing the suction valve and opening the atmospheric valve, allowing air to enter the inner tank through the vent tube, while the gasoline passes through the flapper check valve into the outer tank and from there to the carburetor.



SETTING No. 1



SETTING No. 2



SETTING No. 3

Plate No. 10
Carburetor Settings

The action of the vacuum tank is entirely automatic. There are no adjustments, and it will require no attention aside from an occasional examination of the connections to see that they are tight and free from dirt. It is advisable to drain the tank every 500 miles to remove any sediment that may have collected.

If vacuum tank runs dry, with no air leak in gas line, close throttle and crank engine 15 or 20 turns with starter. Then release starter and wait two or three minutes, then start engine in usual manner.

The gasoline tank in the rear should be drained every 2000 miles to remove any sediment and prevent same from reaching the carburetor and causing trouble.

Do not allow the vent tube or the small hole in the gasoline tank filler cap to get stopped up with dirt.

CARBURETOR AND HEAT CONTROL

The carburetor is the instrument which measures the fuel charges for the engine and automatically mixes them with the proper amount of air to form a combustible gas.

The float chamber contains a float attached to a valve in such a manner that fuel is admitted to the mixing chamber of the carburetor only as it is needed to maintain a constant level in the spray nozzle. The spray nozzzle opening is regulated by a gasoline needle valve which constitutes the gasoline adjustment and it is surrounded by a venturi tube through which a portion of the incoming air passes at high velocity, picking up gasoline from the end of the nozzle in passing.

The mixing chamber also contains the air valve and the high speed nozzle.

The air valve is pressed against its seat by an adjustable spring which is housed inside of the air screw and connected with the air valve by means of a connecting rod, the adjustment of the air screw constituting the air adjustment. As the speed of the engine increases the velocity of the entering air increases until the air valve is lifted from its seat and at the same time an additional amount of gasoline is taken from the high speed nozzle.

The air valve is hinged on the insert which is housed by the mixing chamber and the insert also carries the spray-nozzle already referred to. On the under side of the insert is located a dash-pot which houses a plunger valve or diaphragm which in turn retards the too quick opening of the air valve in acceleration of the engine thus assisting in acceleration or quick pick-up. The dash-pot fills with gasolnie automatically, the supply of gasoline for same coming from the back-wash or drift occurring when the carburetor is choked for starting and finding its place in the dash-pot by gravity from the mixing chamber.

The dash-pot is just as effective when operating without gasoline in it as with it, nor is its action affected by the quantity of gasoline in it. The purpose of allowing gasoline to get in it at all is merely for lubrication, hence the dash-pot is entirely automatic and requires no attention and should be left entirely alone.

The air enters the carburetor through a three-way valve connected to the air-regulator marked "Cold," "Hot," and "Choke" on the instrument board. By means of this valve with the air-regulator pointing to "Hot," the air can be taken from the heater under the exhaust manifold or with the regulator pointing to "Cold," directly from the atmosphere. When the regulator on the instrument board passes to the right of "Hot" it commences to retard the volume of air, thus increasing the volume of gasoline in proportion to the air and may be used in this way for warming up the engine but should be returned to "Hot" position or further toward "Cold," depending upon the season of the year, just as soon as engine has become warm and is taking its fuel freely or otherwise more fuel will be used than necessary.

The air-regulator when standing in complete "Choke" position further closes the air supply and causes the carburetor to give off excessively rich charges for starting and should be released to part choke as soon as engine fires in starting, part choke meaning two-thirds of way back toward "Hot" and upon engine being warmed up, further released to "Hot" or still further toward "Cold," depending upon the season of the year as described above.

The passage-way from the mixing chamber to the intake manifold is controlled by a butterfly valve which is called the throttle-valve and is connected to the throttle-lever on the steering wheel as well as to the foot accelerator, its position determining the amount of gas being fed to the engine.

The upper portion of the mixing chamber is surrounded by a large heat jacket provided with an inlet and an outlet opening and connected by means of tubes to an exhaust manifold valve body in the exhaust pipe of the engine; the inlet tube to carburetor jacket entering the exhaust manifold valve body in the upper portion above the exhaust valve and the outlet tube of the carburetor jacket entering the exhaust manifold valve body in the lower portion below the exhaust valve, the exhaust valve being connected by means of a lever and a connecting rod to the throttle lever of the carburetor. The purpose of the carburetor heat jacket and valve in exhaust line with connections described, is to provide means for utilizing the heat of the exhaust gases from the motor for better vaporization of the fuel supplied the engine and to do so automatically. The automatic feature of same is accomplished by setting the exhaust valve, by means of the connecting rod, in closed position with the closed or idling position of the throttle valve, thus causing all of the exhaust gases of the engine to pass through the heat jacket of the carburetor when engine is idling and to regulate the volume of this heat as throttle valve is opened and engine speed increased, by automatically opening the exhaust valve in the exhaust pipe, thus decreasing the pressure or volume of the hot exhaust gases by-passed through the heat jacket of carburetor.

By referring to the cut shown on page 30 and noting "Setting No. 1," it will be noted that Valve "A" in Exhaust Line is fully closed with the idling position of the throttle valve and that Valve "B" is set in open position. This setting provides for the most heat obtainable and should be used this way during the **entire year** except in extremely hot seasons or hot climates or when high-test gasoline is being used in engine and even then unless engine is losing power due to excessive heat. If loss of power due to too much heat is experienced, refer to cut on page 30 describing "Setting No. 2." It will be noted that connecting rod from Valve "A" in Exhaust Line is removed from "Hole No. 1" in throttle lever and placed in "Hole No. 2." It should be noted also that Valve "B" is not disturbed but is allowed to remain in open position. Valve "B" should be left **entirely alone** except in **extremely hot climates** or when using high-test gasoline or other highly volatile fuel.

"Setting No. 2" provides all of the regulation of the heat required except in very extreme conditions of climate and fuel described. Valve "B" should never be disturbed nor "Setting No. 3" as described in cut on page 30 be used until after "Setting No. 2" has been tried together (if necessary) with air Regulator on dash set at "Cold" after warming up and under no circumstances should Valve "B" be closed when "Setting No. 1" of the Exhaust Valve is being used.

ADJUSTMENT OF CARBURETOR

For adjusting the carburetor note the following:

Refer to the directions above for "Heat Setting No. 1" and so adust the heat.

1. Turn gasoline adjustment to the right very carefully so as not to

injure the needle point until the needle valve is closed gently against its seat, then turn it to the left to open seven eighths of one turn.

2. Set air adjusting screw so that end of screw is even with the end of the ratchet set spring above it.

3. Start engine as usual, allowing it to run a few minutes with air regulator on dash turned to "Hot" or part choked until engine is warmed up finally leaving air regulator on "Hot."

4. With the spark lever fully retarded, turn gasoline adjustment to the right, closing needle valve until engine idles smoothly. The normal adjustment of the needle valve is usually about three-fourths of one turn open.

5. Advance spark lever and turn air adjustment screw to the left, a little at a time, until the engine begins to slow down or skip indicating too much air; then turn it to the right until the engine idles smoothly. If engine idles too fast with throttle fully closed, change closed position of throttle to further closed by means of throttle lever set-screw.

6. To test the adjustment, leave spark lever advanced and open throttle lever quickly. The engine should accelerate instantly. If it skips or pops back, open gasoline adjustment slightly by turning needle valve to the left. Do not touch air adjustment unless it appears absolutely necessary. The best adjustment is obtained with gasoline adjustment set at about three-fourths of a turn and the air adjustment carried as light as possible for quick acceleration with fully advanced spark, the position of the end of air screw being about even with the ratchet set spring above it.

After the carburetor has been adjusted as described above and proper idling speed of engine obtained, the connecting rod from exhaust valve to throttle lever of carburetor should be readjusted to be sure that Exhaust Valve as described in cut on page 30 is fully closed in "Heat Setting No. 1" when engine is idling.

Do not attempt to adjust carburetor until certain engine has good compression in each cylinder; that a good hot spark occurs at each plug at the proper time; and that gasoline is reaching the carburetor regularly from the vacuum tank. The carburetor should be the last thing to touch.

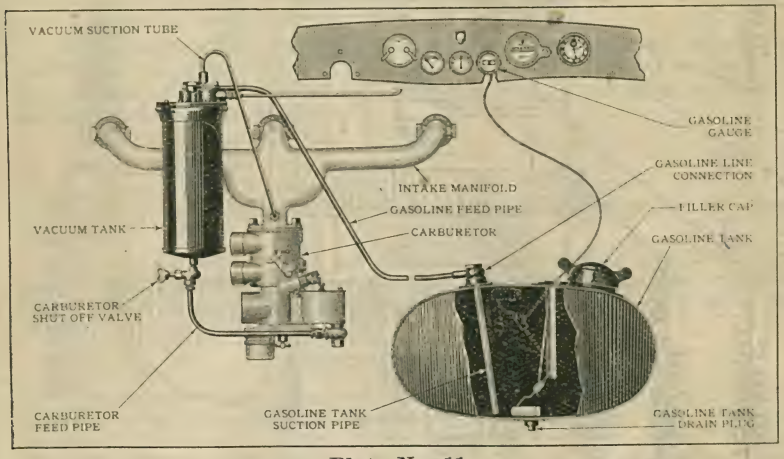


Plate No. 11
Gasoline System for All Models

GASOLINE GAUGE FOR ALL MODELS.

In order that the operator may be fully acquainted with the supply of gasoline in the tank at all times a visual gasoline gauge has been adopted

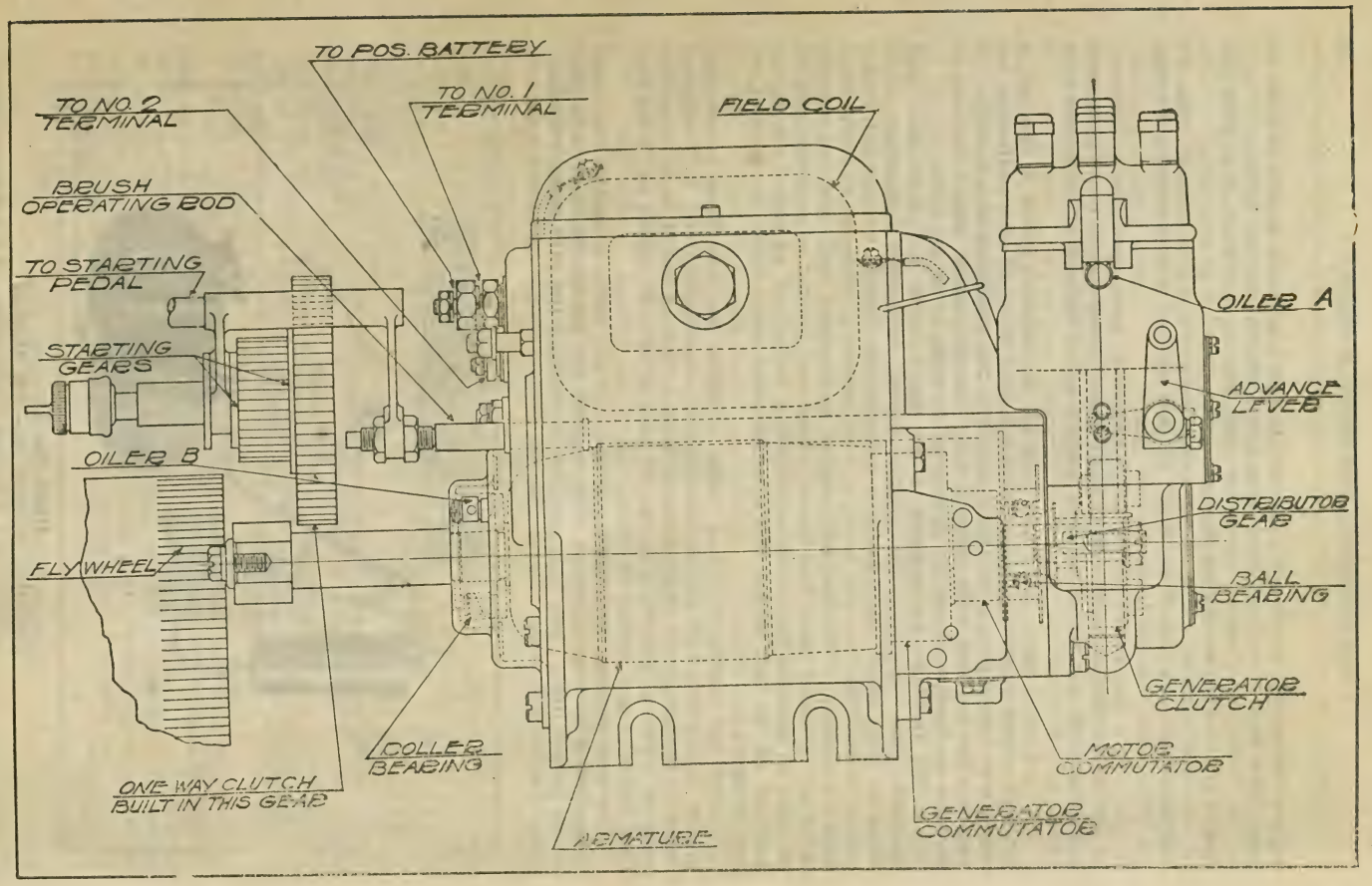


Plate No. 12
Side View of Motor Generator

and very conveniently located on the dash and is a mechanically operatnig device which registers at all times the quantity of gasoline remaining in the gasoline tank attached to the rear of the car.

It consists of a cork float, a piano wire and a graduating registering dial. The cork float is fastened to the tank base extension by means of an arm bent at the proper angle which raises and lowers as the gasoline level changes.

The piano wire is attached to the float arm by means of a clip and as the float raises and lowers it forces the wire to oscillate in and out of the tank through an aperture in the tank base which is fastened to the tank, from which a flexible tube or casing extends to the gauge on the dash inside of which the piano wire oscillates.

The graduating dial or drum is enclosed in a housing which fastens to the instrument plate and the gasoline level is registered by the longitudinal motion of the wire. The drum is supported by pivot pins and a constant tension is maintained with a hair spring adjustment set in such a manner as to permit the drum to rotate. The registering figures are placed on the outside of the drum and show through a small aperture in the face of the instrument conveniently located on the dash. To adjust gasoline gauge loosen small brass Hexican Nut which will be found back of the instrument board and on the upper end of gas. gauge cable about six inches back from the gauge. When this nut has been loosened pull cable up or down whichever way you want to regulate gauge or according to the amount of gasline in the tank. To get as near the correct adjustment as possible on the gauge all gasoline in the supply tank at the back should be drained out and adjustment then made to cable back of dash. When tank is again filled full with gasoline it will be found that gauge is registering just about correctly. If gauge does not then correspond with quantity of gasoline in tank necessary adjustment could again be made by moving cable required amount in opposite way to which it was adjusted to empty tank.

DELCO SYSTEM

The single unit Delco starting, lighting and ignition system as furnished for the 1922 McLaughlin models is built expressly to meet the requirements of this particular engine and car. It consists of the following Delco units as assemblies:

Motor-Generator No. 184.
Motor Clutch No. 12224.
Ignition Coil No. 2159.
Lighting and Ignition Switch No. 1159, and the necessary terminals and clips.

The entire system is of the six-volt, single wire or grounded type, the engine and frame of the car forming one side of the electrical circuit. The Delco apparatus does not include the storage battery, lamps, horn or wiring.

MOTOR-GENERATOR

The motor-generator serves both as a generator of current and as an electric motor for cranking the engine when starting. The principal elements of the motor generator are an armature and a field. There are two windings on the armature and two in the field. One of the armature windings and one of the field windings are known as motor windings as they are used when the engine is being cranked. The other windings are used primarily for generating.

The distributor is located in the forward end of the motor-generator. This is for the purpose of properly timing and distributing the ignition current for firing the mixture of air and gasoline in the different cylinders.

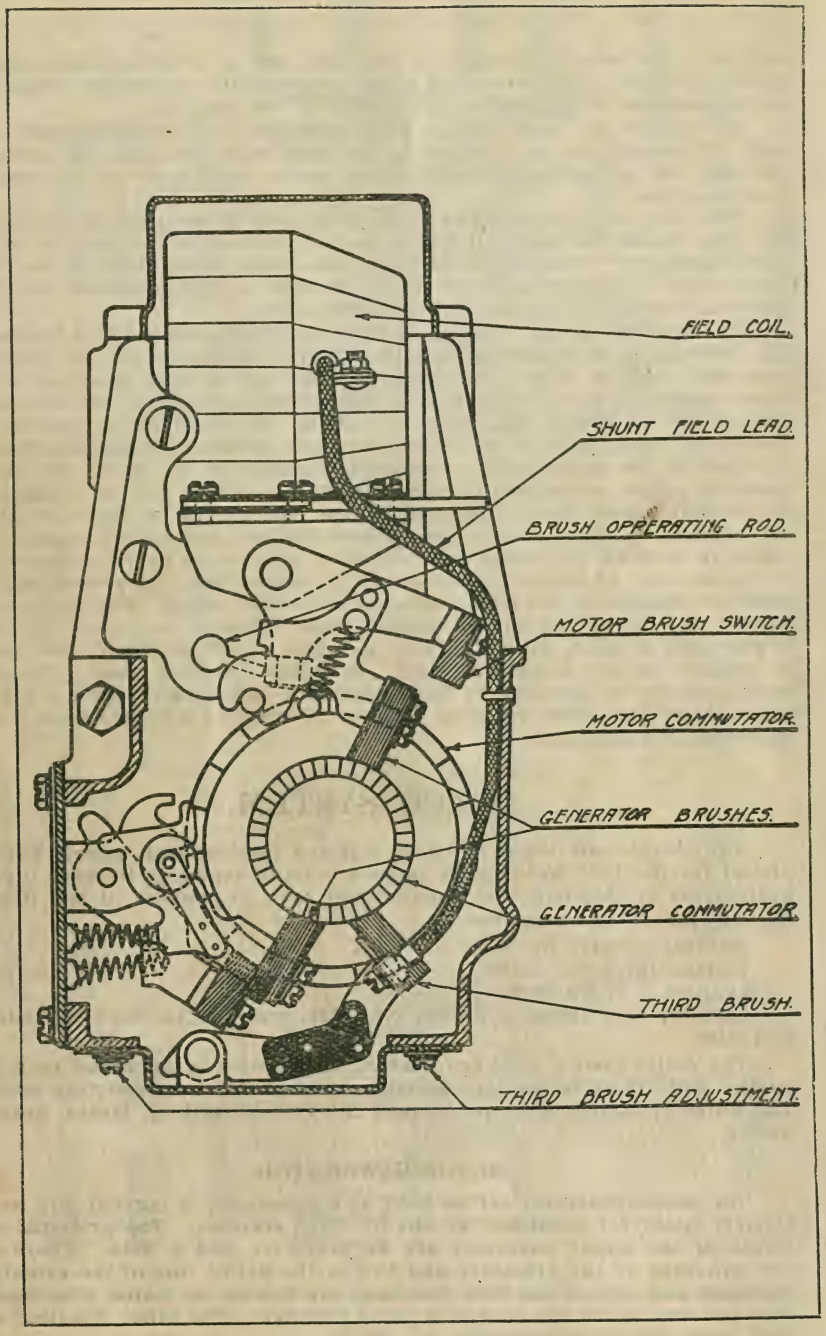


Plate No. 13
End View of Motor Generator

The motor-generator performs three different operations which are as follows:

1. Motoring the generator. This operation is necessary in order that the starting gears may be brought into mesh with the small gear on the armature shaft, and with the teeth on the flywheel. This takes place whenever the "ignition" switch lever is turned to the "IGNITION ON" position. Current then flows from the storage battery through the generator windings, and causes the armature to revolve slowly. A ratchet clutch in the forward end of the motor-generator allows the armature to rotate ahead of the driving shaft. The clicking noise that is heard when the ignition switch is turned on comes from this clutch. In meshing these gears do not try to force them but simply allow the starting pedal to come back, giving the gears time to change their relative positions.

2. Cranking operation. When the starter pedal is pushed down, the circuit between the battery and generator windings is broken. The last movement of the starting pedal causes the upper motor brush to make contact with the motor commutator, thus closing the circuit between the storage battery and the motor windings on the motor-generator, causing it to act as a powerful electric motor which rapidly cranks the engine. This operation requires a heavy discharge from the storage battery. There must be no loose connections in this circuit, which includes the battery conditions, ground wire from the negative terminal of the battery to frame of car, motor connections and brush contact.

As the gear ratio between the armature shaft and the crank shaft is approximately 22 to 1, the armature would be driven at an excessively high rate of speed after starting the engine, and before the operator lets the starter pedal back if it were not for an over-running clutch in the hub of the sliding starter gears between the flywheel and the armature shaft. These gears are assembled in the housing covering the flywheel. The electric motor cranks the engine thru this clutch but after the engine has started and begins to run faster than the electric motor turns it, the starting clutch over-runs.

4. Generating electrical energy. When the starter pedal is let up the first movement breaks the motor circuit between the electric motor and the storage battery, a further movement causes the starter gears to slide out of mesh and the final movement completes the circuit between the generator and the storage battery, which was broken when the starter pedal was pushed down. With the engine running and the circuit closed between the battery and the generator windings, the generation of current begins. At a car speed of approximately seven miles an hour, the generator is operating so that the current is prevented from discharging from the battery through the generator windings. At higher speeds a part of the current generated is used directly for ignition and lighting purposes, while the remainder of the current is charged through the storage battery. The generator output increases to speeds of 18 to 25 miles per hour. At higher speeds the charging rate decreases.

The general construction of the motor-generator is shown in the cross sections. Plate No. 12.

REGULATION

The third brush method of generator regulation is used. The third brush to which one of the generator field leads is connected, is mounted on an adjustable plate between the two main brushes. When this brusn is used, it is the natural characteristic of the generator to have the field current decrease at high speeds causing a corresponding decrease in the generator output. With this form of regulation it is possible to obtain a fairly high charging rate at low car speeds as well as a charging rate which is very satisfactory for higher car speeds.

It also offers the advantage of being readily adjustable in cases where a driver operates under conditions which are out of the ordinary and re-

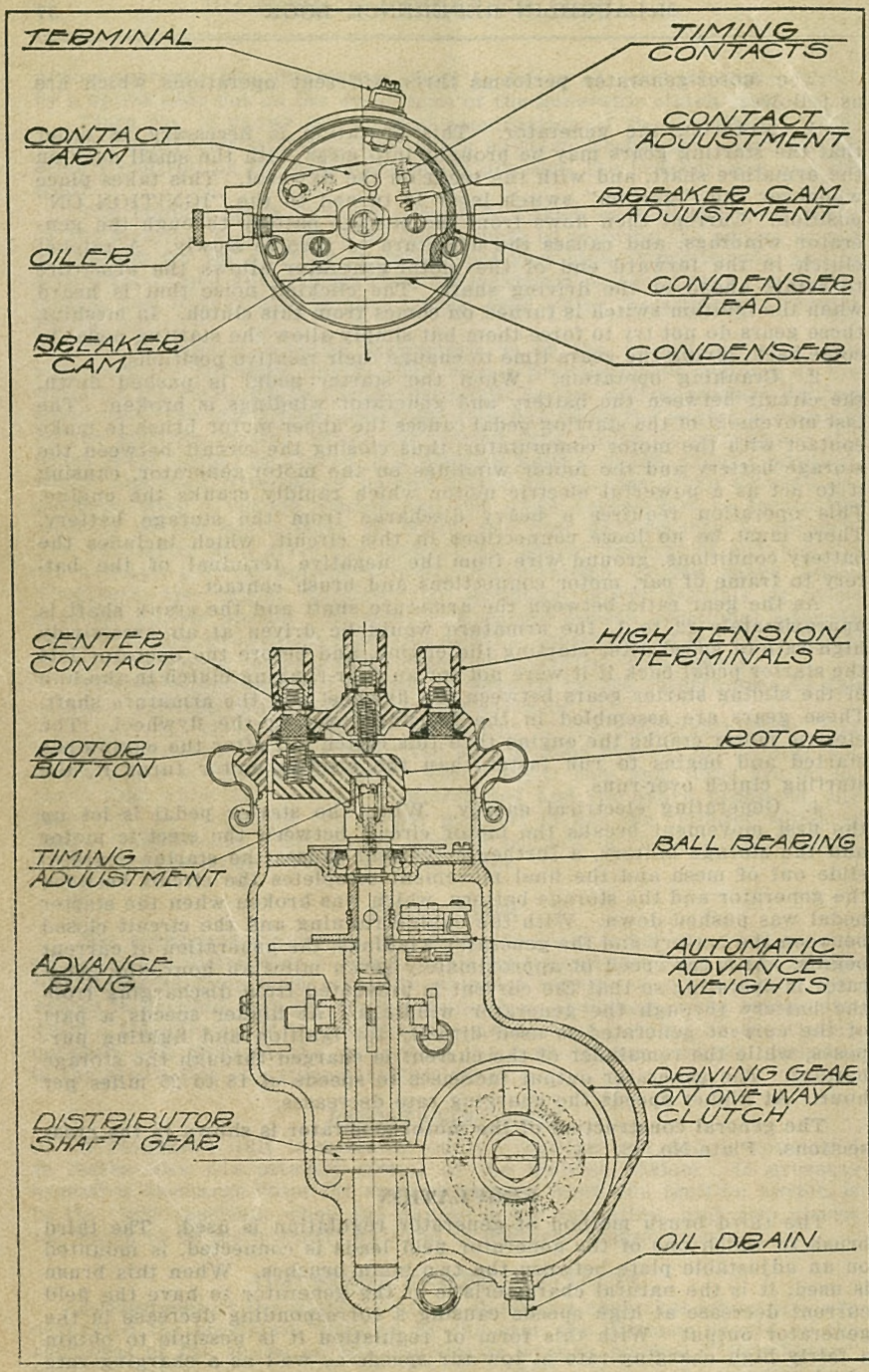


Plate No. 14
Sectional View of Distributor

quire either a higher or a lower charging rate than the average. When the generator leaves the factory it is adjusted to meet the requirements of the average driver.

When the position of the third brush is changed, it is necessary to reseat the brush on the commutator to obtain the maximum true charging rate. To refit the third brush or either of the main generator brushes, place a strip of fine sand paper or sand cloth having a width slightly greater than that of the brush, around at least half of the commutator, with the rough side next to the brush. Drawing the sand cloth back and forth a few times will properly seat the brush. Never use emery cloth.

The charging rate should not be changed except by one who fully understands the work. An ammeter should be connected in the charging circuit and should be carefully observed while the engine is gradually speeded up, and the maximum rate noted. With the lights off, the charging rate should not exceed, in any case, 20 amperes when the generator is hot.

To adjust the position of the third brush, loosen the two adjusting screws indicated in Plate No. 14, and shift the third brush mounting plate slightly to the left or in the same direction that the armature rotates to increase the charging rate. The reverse operation decreases the charging rate. Make sure that all generator brushes are well seated. After the adjustment is complete, tighten securely the two adjusting screws.

LUBRICATION

Lubrication of the parts of the motor-generator should be taken care of as follows:

1. Oiler "A" is for lubricating the upper ball bearing on the distributor shaft. It should receive four or five drops of engine oil each 500 miles.

2. Oiler "B" lubricates the roller bearing on the rear of the armature shaft. Four or five drops of engine oil should be applied each 500 miles.

3. The cover plate on the side of the distributor housing should be removed and the lower part of the distributor housing filled with a soft cup grease to a level just above the manual spark advance ring. This lubricates the advance ring, the distributor timing gears, the generator clutch, the lower distributor shaft bearing and the ball bearings on the forward end of the armature shaft. The grease should be cleaned out and replaced with new once each season. In cold weather it is advisable to add some engine oil.

4. When the front end cover over the commutators is removed an oil hole for supplying oil direct to the armature shaft ball bearing is exposed. Apply three or four drops of engine oil each 500 miles.

5. An Alemite fitting supplies lubricant to th estarting gears, shaft and starting clutch. Soft cup grease is forced thru the hollow shaft into the clutch. The shaft should be lubricated every 500 miles. The motor clutch should be taken apart by a competent mcehanic, cleaned and repacked with soft cup grease once each season.

6 The rubber track in the distributor head upon which the steel rotor button bears should receive a small amount of vaseline applied two or three times during the first 2000 miles driving. The track will then become glazed. It is then only necessary to wipe out the distributor head occasionally with a clean cloth.

7. A very small amount of vaseline should be applied to the surface of the breaker ca meach 1000 miles.

8. Do not for any reason put oil grease on the commutators of the motor-generator.

DISTRIBUTOR

The distributor is mounted on the front end of the motor-generator, and its purpose is to secure the proper timing and distribution of the ig-

nition current. The distributor shaft is driven at one-half engine speed by a spiral gear cut on the outer edge of the generator clutch shell.

Plate No. 15 shows the general construction of th edistributor. The vertical shaft carries the manual spark advance mechanism, governor assembly controlling the automatic spark advance, the breaker cam and the rotor.

The manual spark advance control is linked up with the spark lever on the steering wheel, and is for the purpose of securing the propre retard of ignition for the starting operation and very slow idling speeds, and to secure the proper advance required for maximum power at very low engine speeds, and at very high engine speeds, over which the automatic feature has no control.

The automatic advance mechanism is of the centrifugal type and automatically advances the breaker cam a predetermined amount at the different speeds at which the engine might be run during average driving conditions. The spark lever should be retarded while the engine is cranked by the starting motor. When the engine runs under its own power the spark lever should be placed in a position known as the driving position, which has been determined by the motor car builder. The driver's experience with a certain engine and car often assists him to locate the position of the spark lever at which the best performance is secured. The automatic then gives the ignition the proper amount of advance for all average driving speeds without manipulation of the spark lever. Therefore, the engine develops the maximum power possible at these average driving speeds. At very high engine speeds additional advance should be secured through a further advance movement of the spark lever, in order to obtain the maximum power at extremely high speeds.

Timing of the ignition current is effected by the interruption of the primary ignition current by the timing contacts.

The rotor is carried on the upper end of the distributor shaft, and is for the purpose of distributing the high tension current to the different spark plugs at the proper time. The breaker cam and rotor are so located that when the current is interrupted and the spark produced, the rotor will be located in the proper position to fire the cylinder which is under compression. The center plunger contact in the distributor head should always make contact with the rotor.

CONDENSER

The condenser is enclosed in a moisture-proof metal case, and mounted inside the distributor housing. This consists of two long strips of tinfoil insulated from each other by strips of paraffined paper. It is connected in parallel with the timing contacts, as indicated in the circuit diagram. Its purpose is to decrease the amount of burning at the timing contacts and increase the voltage of the high tension current, assisting in the production of a strong ignition spark.

RESISTANCE UNIT

A resistance unit is mounted on the ignition coil and is connected in series with the primary circuit of the ignition system. It prevents excessive discharge from the storage battery when the ignition switch is in the "ON" position when the engine is not operating, and also causes the spark to be more nearly uniform at different engine speeds.

ADJUSTING TIMING CONTACTS

Adjustment of the timing contacts should be such that when they are separated the maximum distance by the cam, the distance should be the thickness of the gauge on the distributor wrench marked "Distributor," which is twenty thousandths of an inch (.020"). Due to the wearing to a seat of the fiber rubbing block on the contact arm, one or two adjustments may possibly be necessary during the first 2000 miles driving, after which